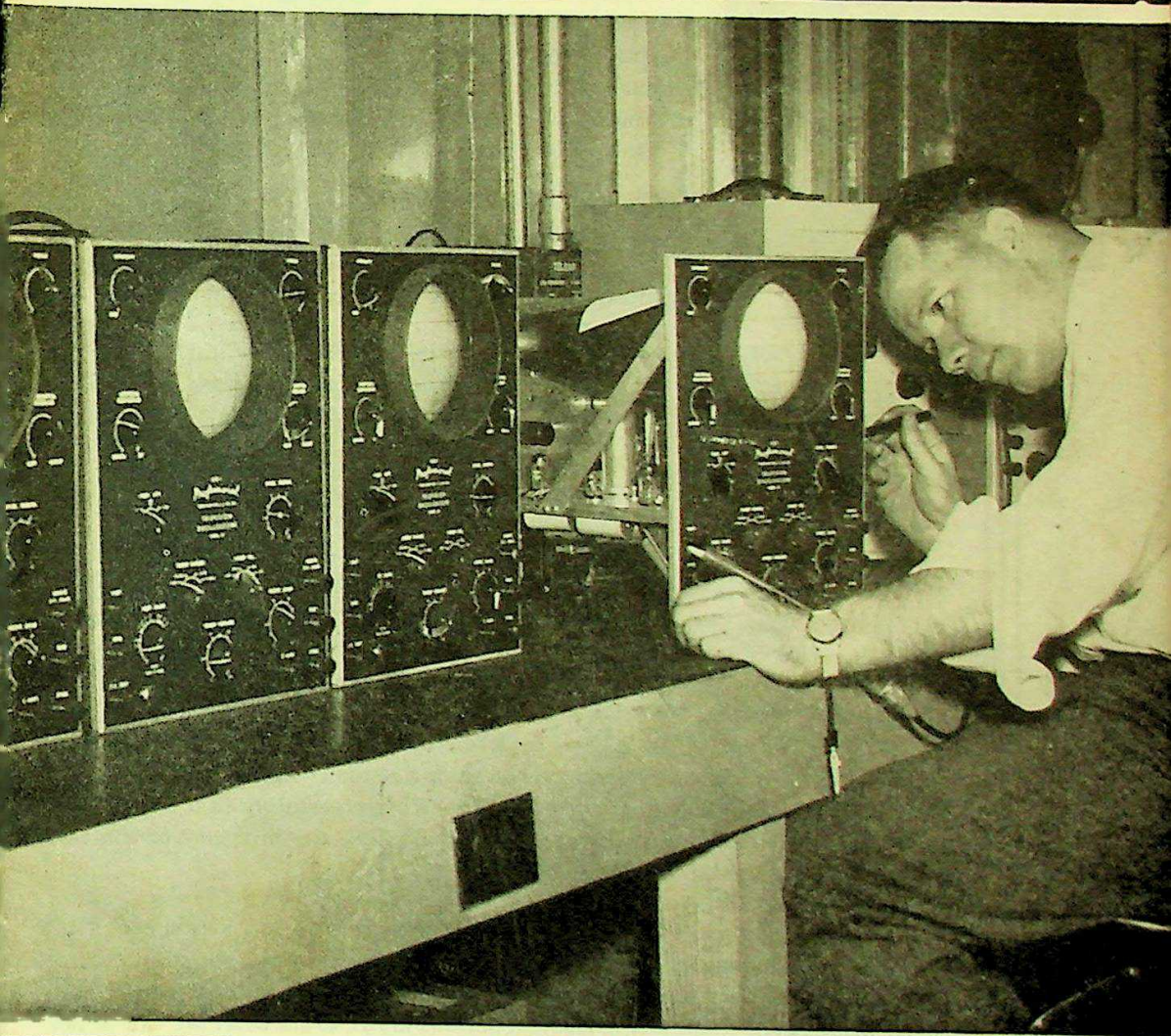
National RADIO-TV NEWS



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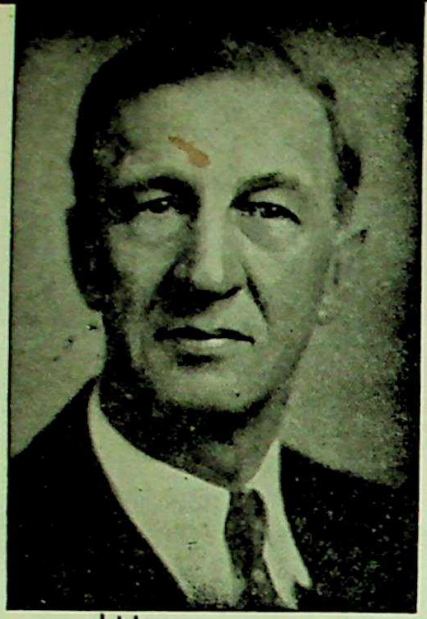


Need for a Moral Revival

When Thomas R. Marshall was Vice President of the United States he was often quoted as having said what our country needed most was a good five-cent cigar. The people took that good naturedly. Things were in pretty good shape back in 1912-1913.

The recent Kefauver Investigation, some of which was Televised and viewed by millions of people, awakened Americans to the thought that what our country needs most right now is a moral revival.

Protected gambling on a nation-wide scale, rackets of one kind or another, kick-backs to public officials, influence peddling, black markets, shady dealings, have become entirely too prevalent.

The Kefauver Investigation and other headlines in the news show that Americans need to come to some agreement on just what are the moral standards of this day and age.

In many cases those in the offending group are not conscious of their own offenses. They feel that as long as they keep within the letter of the law their practices are highly moral.

Senator J. William Fulbright of Arkansas, summed it all up very well when he recently said: "One of the most disturbing aspects of this problem of ethical conduct is the revelation that among so many influential people, morality has become identical with legality. We are certainly in a tragic plight if the acceptable standard by which we measure the integrity of a man is that he keep within the letter of the law."

The distinguished senator voices the sentiments of a large segment of our citizenry who are apprehensive about the decline in our moral standards, and who want to see something done about it. Is it not time for all of us, by precept and example, to make a serious effort to do what we can to help return America to a code of living standards that are based on the Golden Rule?

J. E. SMITH, *President.*

Louis E. Garner, Jr.

Using the NRI Professional TV Oscilloscope in Radio-TV Servicing

By LOUIS E. GARNER, JR.
NRI Consultant

WHILE oscilloscopes have been generally available to servicemen for some time, it has been with the advent of television that the scope has really "come into its own" as a professional servicing instrument. Many experienced Radio-TV servicemen, particularly those doing a moderate to large volume of work, consider the oscilloscope to be an indispensable instrument.

Although its primary value is in the service of television receivers, it may be used to advantage in servicing ordinary FM receivers, PA amplifiers, and phonograph amplifiers.

A detailed study of the theory of operation of the cathode-ray tube and/or the complete oscilloscope is too broad a subject to cover in a single article. We will discuss here only the application of the instrument in radio and television servicing.

Because of the widespread interest in the new NRI Professional TV Oscilloscope, we shall base our discussion on the use of this instrument.

However, most of the techniques described may be employed with other oscilloscopes of comparable quality. For a more detailed explanation of the general operation of an oscilloscope refer to your regular NRI lesson text material.

Some of the special features found in the NRI Professional TV Oscilloscope include calibrated attenuator controls which permit the serviceman to read peak-to-peak ac voltages directly. No calculations are necessary. This one feature alone will save many hours of servicing time and will aid in a speedier diagnosis of troubles.

Another special feature is the use of a wide-band vertical amplifier which makes it possible to observe most complex signals without distortion. Still other features include the use of a wide-range sweep circuit with unusual synchronizing abilities. It can be synchronized with sine waves having a frequency as high as several megacycles. (A sine wave, incidentally, is the most difficult type of signal to use for synchronizing a sweep circuit.)

All these features combine to make the NRI Professional Oscilloscope an instrument any serviceman would be proud to own and use. In keeping with the high quality of its technical performance, the final appearance of the instrument has been kept dignified, yet impressive (see Fig. 1).

Before discussing the use of the oscilloscope in service work, let us familiarize ourselves with the various controls and how they are used.

How to Use the Oscilloscope

Detailed and complete instructions on the use of the Model 55 NRI Professional TV Oscilloscope are given in the Instruction Manual furnished with the instrument. Any student or graduate purchasing this oscilloscope is urged to read carefully and to follow the instructions for getting familiar with the instrument and its operation. This will help him to obtain maximum usefulness from his instrument.

At first glance, the number of controls on the

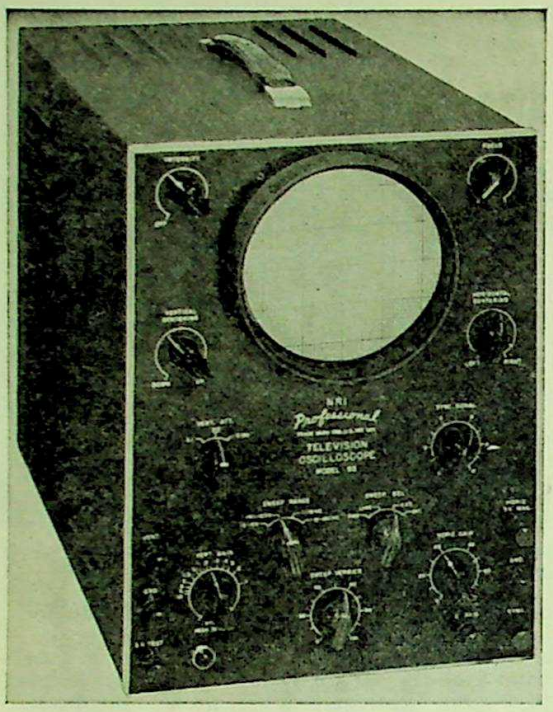


Fig. 1. Over-all view of the Model 55 NRI Professional TV Oscilloscope.

front panel (see Fig. 2) may be confusing, but once you learn the function of each you'll find that the oscilloscope is really a very simple instrument to use. Confidence will come with experience in its operation.

There are several groups of basic controls on this instrument. We will discuss first the group used for "setting up" the instrument, and which are normally left fixed in position once an image is obtained.

How to Obtain an Image

To turn on the instrument (see Fig. 2), turn the "INTENSITY" control in a clockwise direction until a click is heard and the pilot light is seen to glow. Allow the instrument to warm up. Now, turn the HORIZONAL and VERTICAL CENTERING controls to about the mid-point of their rotation. Turn the INTENSITY control in a clockwise direction until a glow or spot can be observed somewhere on the screen of the tube.

Once the spot or glow is visible, adjust the FOCUS control until the spot is as sharp as it can be made. Notice while operating the FOCUS control that there will be one position where the sharpest spot can be obtained, and that turning the control to either side of this position will cause the spot to broaden and lose focus.

Now adjust the HORIZONTAL and VERTICAL CENTERING controls, and watch the spot move up and down and back and forth across the screen. Finally, adjust both controls to center the spot on the screen as shown in Fig. 3A. (Note: Do not allow a single spot to remain on the face of the CR tube for any length of time, as the stream of electrons can damage the screen.)

To provide a horizontal sweep for the signal, turn the SWEEP SEL. switch to the INT. position. This turns ON the built-in sweep circuit and provides internal syncing for the signal. Turn up the HORIZ. GAIN, noting that the spot turns into a line as shown in Fig. 3B. The width of the line can be adjusted with this control. You may note that the line tends to "flicker" due to a low sweep rate. With the SWEEP RANGE and SWEEP VERNIER controls in their extreme counterclockwise position, the sweep rate is about 10 cycles per second, far below the "flicker rate" for the eye.

To obtain a test sine wave pattern on the screen of the oscilloscope, connect a short piece of wire between the terminal marked "2V TEST" and the terminal marked VERT. Turn the VERT. GAIN control in a clockwise direction until about two or three inches of vertical sweep (up and down) is obtained. Adjust the SWEEP VERNIER and SYNC SIGNAL controls until 3 or 4 complete sine waves are obtained on the screen of the oscilloscope as shown in Fig. 3C.

The SWEEP VERNIER and SYNC SIGNAL controls should be adjusted for a stable or stationary pattern. (The SYNC control should be kept as far counter-clockwise as possible while still obtaining a stable signal.) You are now observing the 60-cycle sine wave as it appears on the 115-volt power line.

The procedure outlined above is the basic one used for obtaining an image or pattern on the screen of the oscilloscope. By adjusting the SWEEP VERNIER control you can change the number of cycles observed from approximately 5 to 1 complete cycle, because the number of cycles seen on the screen depends on the sweep rate of the built-in linear sweep with respect to the signal observed. As an example, if the sweep rate in the oscilloscope is 60 cycles per second, and we are looking at a 60-cycle per second signal, one cycle will be observed. If the sweep rate is 30 cycles per second, with the same input signal, two complete cycles will be observed.

This procedure for obtaining an image should serve as a guide for beginners and those not familiar with the operation of the instrument. For more complete instructions on the operation

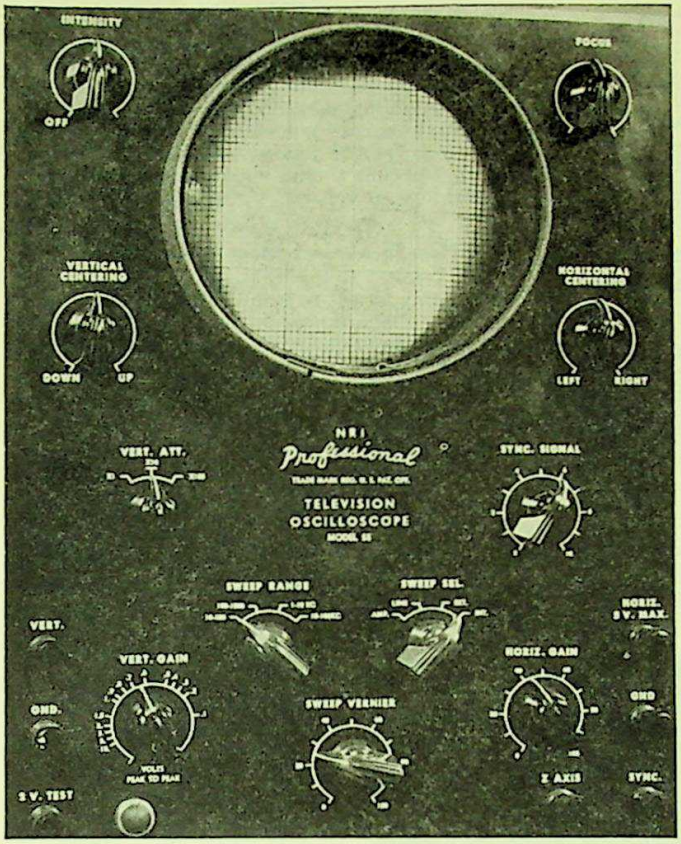


Fig. 2. Close-up view of front panel showing arrangement of controls and switches for ease of operation.

of the oscilloscope and the exact purpose of each control, refer to the Instruction Manual included with the instrument.

In the normal operation of the oscilloscope, you will find that the VERTICAL ATTENUATOR, VERTICAL GAIN, SWEEP RANGE, SWEEP VERNIER, and SYNC SIGNAL controls are the ones most often adjusted; the HORIZ. GAIN control will need adjusting occasionally. The other controls (INTENSITY, FOCUS, VERTICAL CENTERING, HORIZONTAL CENTERING, and SWEEP SELECTOR) are left more or less fixed in position.

Fig. 3. A B C

How to Measure Peak-to-Peak Voltages

One thing the radio-television technician soon learns about ac signals is the many ways to express their voltage. Most ac voltmeters are designed to read the effective or RMS (root mean square) voltage. In Fig. 4, the RMS value of a sine wave is approximately .707 of the peak voltage. Peak voltage is the maximum reached during a cycle.

There is still another value which is sometimes considered — the "average" value of a rectified sine wave, which is approximately .636 of the peak value, as explained in your NRI lessons.

For most radio and electrical work, the RMS value is used, since sine waves are about the only type of signal encountered. When dealing with television, however, pulse waveforms are likely to be encountered (see Fig. 5). Here, the RMS or the average voltage may be very small compared to the peak voltage, and may be almost meaningless. The peak value, however, is important because it determines whether or not the signal functions properly for syncing or other purposes.

Because of the odd waveshapes encountered, sometimes even the peak value is not important since this refers to the maximum voltage reached in either direction from "zero." In the wave-form shown in Fig. 5, the positive peak is high, whereas the negative peak is close to zero. Therefore, in television work we speak of peak-to-peak voltages. This is the voltage from the highest positive point of the cycle

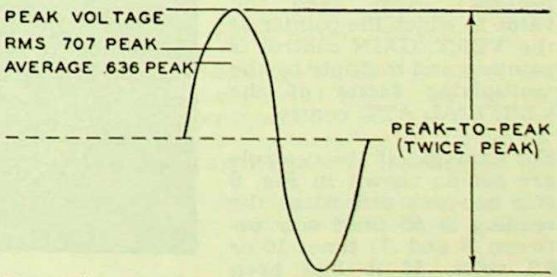


Fig. 4. Portions of a sine wave representing average, RMS, peak, and peak-to-peak voltages.

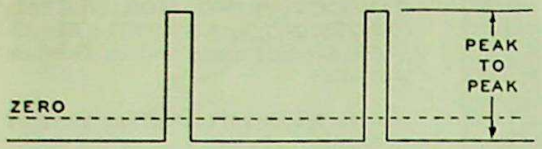


Fig. 5. Illustration of what is meant by the peak-to-peak amplitude of a pulse signal.

to the highest negative point of the cycle as shown in Fig. 4 for a sine wave, and in Fig. 5 for a pulse wave.

Most manufacturers list the peak-to-peak voltages of waveforms encountered in various sections of their receivers. It is necessary that the television technician be able to measure these voltages.

With the NRI Professional Oscilloscope, this is a comparatively simple operation, for it is calibrated so that peak-to-peak ac voltages may be read directly with an accuracy that is sufficient for all normal work. To measure the peak-to-peak voltage of a signal, connect the signal to the VERT. and GND. terminals. The ground terminal is generally connected to the chassis of the equipment being tested.

The SWEEP RANGE, SWEEP VERNIER and SYNC SIGNAL controls as well as the VERT. GAIN and VERTICAL ATTENUATOR controls are adjusted until two or three cycles of the signal are observed on the screen of the instrument. Adjust the VERTICAL ATTENUATOR and VERTICAL GAIN controls until one-inch deflection is obtained on the screen of the tube. (A calibrated transparent graph scale is provided to make it easy to adjust for exactly one-inch deflection.) Now, read the value to which the pointer of the VERT. GAIN control is pointing and multiply by the multiplying factor of the VERTICAL ATT. control.

For example, if the controls are set as shown in Fig. 6 (for one-inch deflection) the reading is .65 (half way between .6 and .7) times 10 or 6.5 volts. If it had been necessary to turn the VERTICAL ATTENUATOR to the X1 position to obtain one-inch deflection, the reading would have been .65 volt. Similarly, if it had been necessary to turn the VERTICAL ATTENUATOR control back to the X100 position, the reading would have been 65 volts. This same general procedure may always be used to measure the peak-to-peak voltage of an ac signal, whether a sine wave, a pulse wave, or some complex waveform.

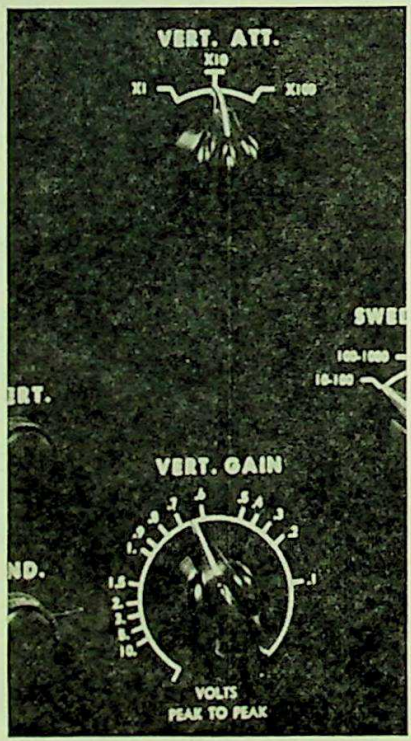


Fig. 6. Close-up of vertical attenuator and vertical gain controls.

How to Measure Hum Frequency

Often it is important to know whether a particular hum condition is 60- or 120-cycle hum. This can be determined easily by using the NRI Oscilloscope.

To measure the frequency of a hum signal, first turn the SWEEP SEL. switch to the LINE position. Connect the 2V TEST signal to the vertical input terminal and turn up the gain control until about 2 inches deflection is obtained (with the vertical attenuator in the X1 position). Adjust the SWEEP RANGE and SWEEP VERNIER controls together with the SYNC SIGNAL control until two cycles of the sine wave are obtained on the screen of the cathode-ray tube. The SYNC SIGNAL control should be turned up far enough so that the two complete cycles "lock-in" and remain stationary.

Disconnect the lead between the 2V TEST terminal and the VERT. terminal and connect the signal to be measured between the VERT. and GND. terminals.

Adjust the vertical attenuator and the vertical gain controls until a signal having about the same amplitude as that previously observed is obtained (about two inches). Note whether you obtain 2 cycles or 4 cycles. If two cycles are observed, the hum frequency is 60 cycles per second. If four complete cycles are observed, the hum frequency is 120 cycles per second.

This test is useful when you are in doubt about the frequency of a hum signal in a radio receiver, television set, or amplifier. Sixty-cycle hum is generally caused by heater-to-cathode leakage, pick-up, or similar defects where the low-voltage power sup-

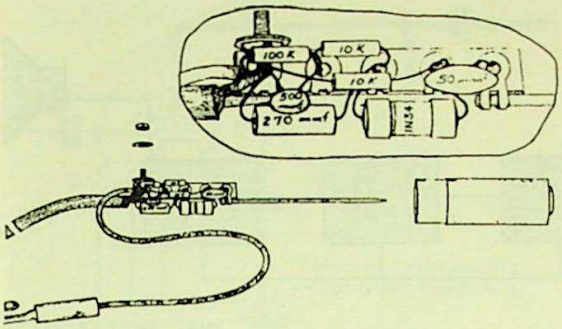


Fig. 7. A suitable detector probe which can easily be constructed for use with the oscilloscope.

ply is a full-wave supply. It may also be caused by a defective rectifier tube, or one-half the high-voltage secondary winding of the power supply being open.

In sets where a half-wave rectifier circuit is used, 60-cycle hum may also be caused by improper filtering action in the power supply, or the previously mentioned causes.

On the other hand, 120-cycle hum is generally found only in sets using full-wave rectification, and it is usually caused by defective filter condensers or improper filter action.

Using the Oscilloscope to Service Radio Receivers and Phonographs

The NRI Professional TV Oscilloscope has been designed to meet the exacting requirements of television servicemen and technicians. It also meets the requirements of servicemen who specialize in AM-FM work or amplifiers and phonographs.

To use the Oscilloscope as an ac voltmeter or output meter: Connect the signal that is to be measured to the vertical input terminals (VERT. and GND.) and adjust the controls, as previously outlined, until three or four complete cycles of the signal to be measured can be observed, with a total deflection of about 2 inches. The SWEEP SEL. switch should be in the INT. position. Use the technique previously outlined for measuring peak-to-peak voltages. To convert the peak-to-peak voltage of a sine wave to RMS voltage, simply divide the measured voltage by 2.82. For practical purposes, you can divide by 3. Thus, if you measure the peak-to-peak voltage of the signal and find it to be about 18 volts, the RMS voltage is approximately 6 volts. *Note that this dividing factor applies only where sine-wave signals are to be measured.*

When the oscilloscope is used as an output meter, connect the GND. lead to the chassis of the receiver and the VERT. lead to either the output of the second detector or the output of the audio output tube. The relative amplitude of the signal may be observed by leaving the VERTICAL ATTENUATOR and the VERTICAL GAIN controls set in position and watching the deflection obtained as an alignment procedure is carried out. Many servicemen prefer to use the oscilloscope as an output indicator rather than using an output meter, since the peak reading is easier to observe.

To use the oscilloscope as a signal tracer: Connect the leads to the GND. and VERT. terminals of the scope. Connect the GND. lead to the chassis of the receiver, phonograph, or other instrument to be checked, and use the VERTICAL lead as a signal tracer probe.

Stage gain may be obtained by measuring the input and the output signals in a particular stage. Use the technique previously outlined for this measurement. Find the stage gain by dividing the output voltage by the input voltage.

As an example, suppose the signal applied to the first audio amplifier of a receiver is three volts, and that the signal amplitude of the output of the stage (between plate and ground) is 60 volts. The stage gain is then 3 divided into 60, or 20.

In the average receiver, the technique for using an oscilloscope as a signal tracer is first to apply a signal to the input of the receiver. This may be a picked-up program, or a modulated rf signal from a signal generator such as the NRI Professional Model 88 Signal Generator. The oscilloscope is used, starting at the second detector, with the technique just outlined (GND. lead to the set chassis and VERT. lead as a signal tracing probe) to check the appearance and the relative amplitude of the audio signal at the output of the second detector stage; from there across the volume control; then between the center tap of the volume control and ground; then from each side of coupling condensers to ground; and all the way up to and including the signal at the voice coil of the loudspeaker. It may also be used to observe the hum output from the power supply circuit.

The above procedure covers the tracing of audio signals. By building a small rf detecting probe (see Fig. 7), the oscilloscope may be used for signal tracing in the i-f, mixer, and rf stages.

In Fig. 8, the oscilloscope is used to check the amplitude and the general appearance of the signal in the stages that are shaded. In the other stages shown, it is necessary to use the rf detector probe in conjunction with the oscilloscope.

A dead stage is identified by the presence of a signal at its input and the absence of a signal at its output.

An open coupling condenser can be identified by the presence of a signal on one side and either

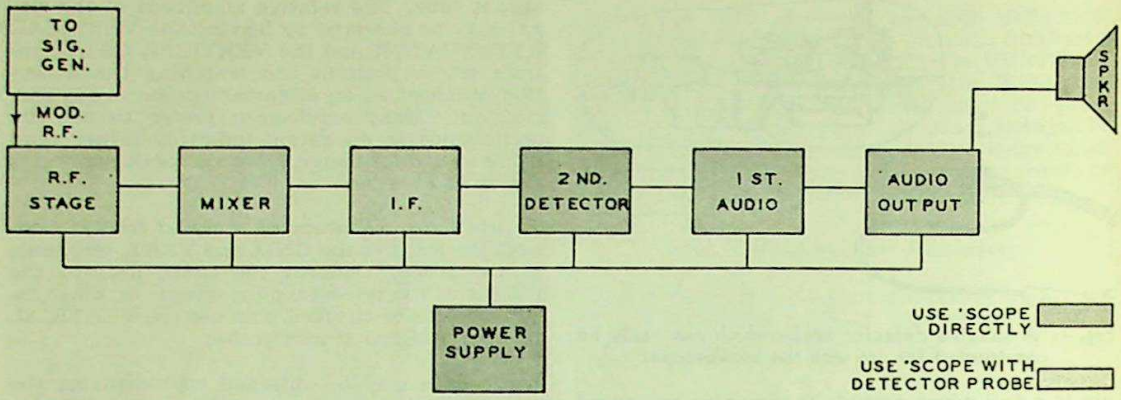


Fig. 8. Block diagram of a radio receiver showing those stages which must be checked using a detector probe with the oscilloscope.

the absence of a signal or one of much lower amplitude on the other side. Thus, the oscilloscope becomes a convenient device for signal tracing.

A weak stage is identified by lower-than-normal gain. In some cases, the input and the output signal may be found to be of approximately the same amplitude. This indicates that no gain whatsoever is obtained from the stage.

Noise or hum is identified by a change in the appearance of the observed signal. With experience, you can soon learn to tell the difference between noise and hum. By using the technique for measuring hum frequency previously outlined, you can tell whether hum is 60-cycle or 120-cycle and thus make a preliminary isolation of the point at which hum is introduced.

Defective by-pass or filter condensers can be identified by the presence of a strong ac signal at the point where the by-pass or filter condenser is connected. For example, in Fig. 9, by-pass condenser C_1 should act effectively to by-pass the audio signals from the screen of the tube to ground. Normally, little or no signal should be observed when the oscilloscope is connected as shown. If a high amplitude signal is observed here, we know that the by-pass condenser C_1 is defective or open.

To check an auto radio vibrator, connect the oscilloscope vertical input terminals across the vibrator transformer primary winding and turn on the receiver. Set the SWEEP SEL. switch in the INT. position, and the SWEEP RANGE and the SWEEP VERNIER controls for three or four cycles. Adjust the vertical attenuator and the vertical gain controls for two or three inches deflection. Normal and defective vibrator wavepatterns are illustrated on page 20 in connection with an article on auto radio servicing, and are therefore not reproduced here.

To check for distortion in an audio amplifier or receiver, connect a sine-wave test signal to the input of the audio stages in a phonograph or public address amplifier; this is the "mike" or "phono" input of the amplifier. In a modern receiver, connect the signal across the volume control. The sine-wave signal source may be an audio oscillator, the audio output of a signal generator, or, in some cases, simply a 60-cycle sine wave obtained from the filament winding of a power transformer, or from the "2V TEST" signal available at the binding post on the front panel of the oscilloscope.

The input sine wave should have the general appearance of a "perfect" sine wave as shown in Fig. 10A.

The internal connections of the NRI Oscilloscope are such that the positive half of the sine wave appears on the upper portion of the cathode-ray tube screen. The polarity marking of the signal on the screen of the NRI Professional Oscilloscope is illustrated in Fig. 10A.

The oscilloscope is used as a signal tracer to check the appearance of the sine-wave signals in various stages of the amplifier. If all the stages are operating properly, the waveform of the signal should be preserved without distortion or change in the waveform throughout each stage. The only real difference observed should be an increase in the amplitude of the signal as additional stages in the equipment are checked (due to the increase in gain). This may necessitate readjusting the VERTICAL ATTENUATOR and the VERTICAL GAIN controls of the oscilloscope. If you find that there is any departure from the "perfect" sine wave in any stage, you know that distortion has occurred.

The type of distortion will often give some clue to its cause. For example, in Fig. 10B, note that the top "half" of the sine wave is flat. If this

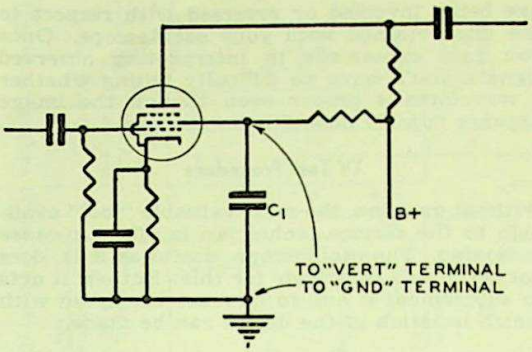


Fig. 9. How the oscilloscope may be used in checking the effectiveness of a by-pass condenser in typical pentode amplifier stage.

signal were observed on the plate of an amplifier stage, it would indicate that the positive half of the observed signal is flat. Because of the phase inversion in the amplifier stage itself, we know that this must be the negative half of the signal *applied* to the grid of the amplifier stage. Hence, the flattening or "clipping" has occurred on the negative half of the applied signal. This is generally caused by excessive bias so that the input signal drives the grid to cut-off.

On the other hand, with too little bias, the waveform in the plate circuit of the tube will have the appearance of the signal shown in Fig. 10C. Such a waveform occurs because the positive half of the applied signal drives the tube to the point where plate current saturation is reached.

Overloading or the application of too strong a signal to an amplifier stage causes both "halves" of the sine wave to be flattened; the signal having the general appearance shown in Fig. 10D.

Use of the Oscilloscope in Television Receiver Servicing

While the cathode-ray oscilloscope is of great value in normal AM-FM servicing and may be used to speed many servicing jobs, it is still possible to conduct a thriving radio service business without having to rely on this instrument. With television, however, an oscilloscope is one of the basic test instruments necessary to do a good servicing job, and to handle the various complaints normally encountered. For some complaints in TV receivers, there is no substitute instrument that

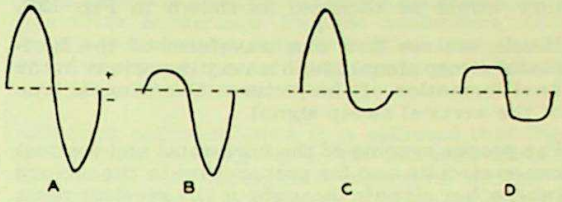


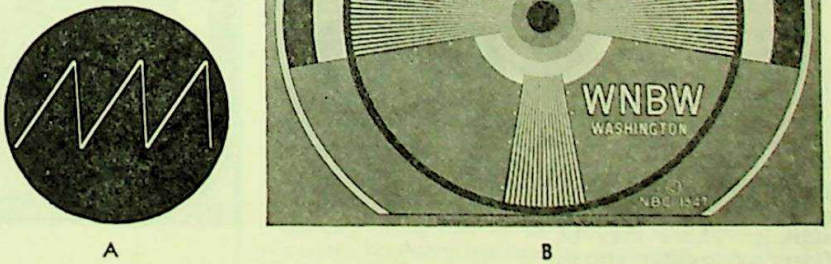
Fig. 10. Typical distortion of a sine wave, resulting from improper bias.

can be used in place of the oscilloscope.

Basically, the technique of using an oscilloscope in TV servicing is similar to that employed in AM-FM servicing. Connect the vertical input terminal of the scope into the circuit at the point where the signal is to be observed and adjust the VERTICAL ATTENUATOR and the VERTICAL GAIN controls to a normal amplitude signal. Adjust the SWEEP RANGE, SWEEP VERNIER, SWEEP SELECTOR, and SYNC SIGNAL controls until three or four complete cycles of the signal to be studied can be seen. The same servicing methods are also employed for signal tracing, checking for distortion, checking by-pass, coupling and filter condensers, checking hum, etc., as *previously* outlined for AM-FM servicing.

Signal waveforms and waveshapes are of much more importance in TV work than they are in other types of electronic work. For instance, in Fig. 11A, a normal saw-tooth sweep signal is shown. This is the type of sweep signal that might be encountered in a receiver employing an electrostatic picture tube and the picture obtained may appear as in Fig. 11B.

If the waveform were distorted and rounded as shown in Fig. 12A, a non-linear and distorted pic-



A B

Fig. 11. Normal saw-tooth horizontal sweep signal with the normal TV test pattern obtained.

ture would be obtained as shown in Fig. 12B.

Hence, we see how the waveform of the horizontal sweep signal alone is very important in the final formation of the picture. The same is true of the vertical sweep signal.

For proper syncing of the horizontal and vertical sweep circuits and for proper drive in the picture tube, other signals throughout the receiver must also have the correct wave-shape and amplitude.

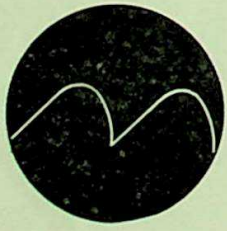
So important are the signal waveforms and amplitudes in a TV receiver that most TV manufacturers include, as a regular part of their service data, the signal waveforms at various points in the receiver, with an indication of the peak-to-peak voltage that should normally exist. When servicing a TV receiver, the serviceman should take full advantage of this information.

It is difficult to outline the general test patterns that will be obtained at various stages in a TV receiver since these vary considerably in the different models. However, in Fig. 13 is given part of the schematic diagram for a popular TV receiver (Sentinel Model 416). At various points in the diagram, signal waveforms are illustrated and the relative amplitude of the signal is given. Such waveforms serve as a guide when servicing the receiver.

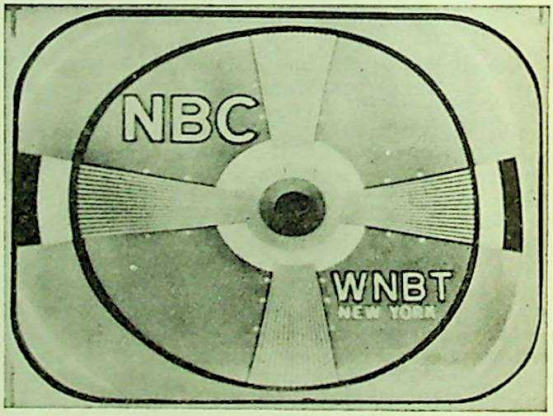
Precautions: When using an oscilloscope in a TV receiver, certain general precautions should always be followed. First, make sure that the peak-to-peak signal in question does not exceed the maximum rating for your oscilloscope. In most cases, there is little to worry about, but at one or two points in the average TV receiver, the peak amplitude of the observed signal is greater than can be safely applied to the input of oscilloscopes.

One example of this is the signal on the plate of the 6CD6G, the horizontal output tube of the receiver shown in Fig. 13. The peak amplitude of the signal is several thousand volts—far greater than the maximum input to your oscilloscope. Under no conditions should the signal applied to the input of the NRI Oscilloscope have a peak value exceeding 1000 volts.

Another precaution to observe is careful interpretation of the sample waveforms given by the manufacturer. Sometimes a manufacturer will use a particular brand or type of oscilloscope to obtain his test signals. There may be fewer or greater stages of amplification which might result in the image being inverted or reversed with respect to the one obtained with your oscilloscope. Once you gain experience in interpreting observed signals, you'll have no difficulty telling whether a waveform is proper even though the image appears "upside down" in some cases.



A



B

Fig. 12. Rounded or non-linear horizontal sweep signal, with the distorted test pattern obtained.

TV Test Procedure

Without question, the most valuable "tool" available to the service technician is *effect-to-cause reasoning*. The oscilloscope, useful as it is, does not serve as a substitute for this. Rather, it acts to supplement it and to increase the speed with which isolation of the defect can be made.

When servicing a TV receiver, a preliminary isolation of the trouble to a section or stage is made by using effect-to-cause reasoning as outlined in your regular NRI lessons. For example, with a complaint such as "sound okay, picture present, but distorted vertically," we know that we should check in the vertical sweep circuit of the instrument. It is here that the oscilloscope becomes of value—with it we can check each stage in the vertical sweep chain, and soon isolate the trouble to a stage and often to a part.

The proper test procedure for servicing a TV receiver, when an oscilloscope is used, may be summed up as follows:

(1) Perform a preliminary isolation to a section by means of "effect-to-cause" reasoning.

(2) Check signal waveforms in individual stages in that section until a departure from the normal waveform shown in the manufacturer's service manual is found.

(3) Check voltages, resistances, or parts in that stage until the defect is finally isolated.

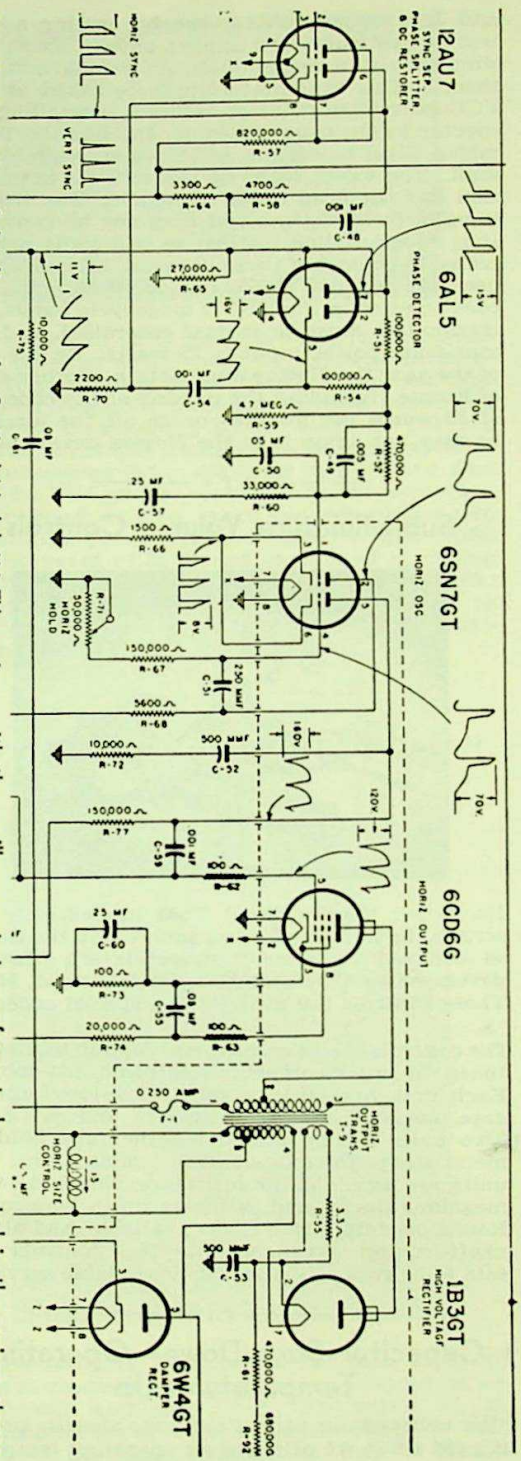


Fig. 13. A portion of the diagram of a Sentinel Model 416 TV receiver, with the oscilloscope test waveforms to be expected in the various stages shown.

Some defective components parts, such as defective filter condensers, by-pass condensers, and coupling condensers may be isolated immediately by means of the oscilloscope alone, in which case step (3) is not necessary.

Although not mentioned, it is assumed that the serviceman working on a TV receiver should first check the tubes in a suspected section—remember that the majority of receiver defects are due to defective tubes. In many cases, a tube tester check is not satisfactory, and the only sure check is to try a replacement known to be in good condition. Only after the tubes are tested in the suspected section should a further isolation of the trouble be made with the oscilloscope.

The oscilloscope is also useful for adjusting special circuits in the TV receiver. An example of this is the horizontal automatic-frequency control circuits employed in some sets.

The detailed adjustment procedure to follow cannot be given here since it varies considerably in the different TV receiver models, depending on the circuit used by the manufacturer. The procedure given for one particular receiver would probably not apply to a receiver made by a different manufacturer. Hence, in all cases refer to the manufacturer's instructions as given in their service manual.

Aligning TV receivers: The oscilloscope is useful for alignment of TV receivers when used in conjunction with a sweep generator. The basic procedure is to connect the rf output from the sweep generator to the TV receiver, either to the antenna terminal or to the input of the video i-f stages. Most sweep generators also provide a "horizontal sweep" signal which is connected to the "horizontal input" of the cathode-ray oscilloscope. The vertical input connections of the oscilloscope are made to the television receiver second detector, but may be made anywhere in the video amplifier circuit.

When the sweep generator, receiver, and oscilloscope are turned on and properly adjusted, the response curve for the video i-f will appear on the screen of the oscilloscope. A "block diagram" showing the general connections for this alignment procedure is shown in Fig. 14.

Figs. 15A and 15B are typical video i-f response curves that can be obtained when an oscilloscope is used. The one shown in Fig. 15A is for a receiver using the intercarrier sound system, and the one shown in Fig. 15B is for a TV receiver using a "conventional" sound system. The phase of the video i-f response curve might be inverted instead of as shown in Fig. 15, depending upon where the oscilloscope is connected in the receiver.

(Page 22, please)

New Amateur Regulations

Effective July 1, 1951, there will be six classes of amateur licenses with three of the six being the classes now in effect and three new ones. The six classes of amateur licenses to be available July 1, 1951, are as follows: Amateur Extra Class (New), Advanced Class C (Formerly Class A), General Class (Formerly Class B), Conditional Class (Formerly Class C), Technician Class (New); and Novice Class (New).

The Amateur Extra Class License will become available to qualified applicants after January 1, 1952. The requirements will be two years holding of an amateur operator's license issued by the FCC, passing a code test at 20 words per minute, passing the present written examination on general theory and regulations if the present license is not a Class A License and passing a new written examination in advanced Radio theory and techniques, presumably considerably more difficult than the present Class A written examination.

The Advanced Class C license is simply a new name for Class A, and its requirements and privileges are the same. Advanced Class Licenses still permit operation in the 75 and 20 meter phone bands, and the licenses may be renewed indefinitely, provided the holder can comply with the renewal requirements. A Class A License will be renewed as an advanced class License without re-examination. New advanced class licenses will not be issued after December 31, 1952.

The General Class License is simply a new name for the Class B License and the conditional class a new name for Class C. No changes have been made in either class as to the requirements or privileges.

The Technician Class License is a new one, becoming available July 1, 1951. Any citizen may obtain one by passing the present (Class B) written examination, both the element covering theory and the one dealing with regulations, and a code test at 5 words per minute. Examinations will be conducted along with others by FCC examiners according to the usual schedule; in addition, the license will be available by the mail on the same basis that Class C now is—i.e., persons living more than 125 miles from the nearest quarterly FCC examining point, or disabled persons or those in the military service unable to appear. Privileges are all those available to amateurs above 220 megacycles. It is a five year license, and renewable.

The Novice Class License is a third new one, also becoming available July 1, 1951. Any citizen, except a former holder of an amateur license (including, incidentally, those issued by military authority in the occupied areas such as Germany and Japan), may obtain one by passing a code test at five words per minute and an extremely simple written examination on regulations and theory. This examination may be taken at any FCC examining point or before a Travelling Inspector on the usual schedule, and like the Technician Class License is additionally available by mail. The exact scope of the written examination has not been set at this time. The license is valid for one year and may not be renewed. It is expected that distinctive call signs will be issued to holders of these licenses. A Novice may use code in the 3700-3750 and 26960-27230 kc. and code or voice in the 145-147 megacycle bands. His transmitter must be crystal controlled, and the maximum power input is 75 watts. By the end of the year the Novice must obtain another class of license (including the passing of the code test of 13 words per minute) or go off the air, and he may not again take the Novice examination.

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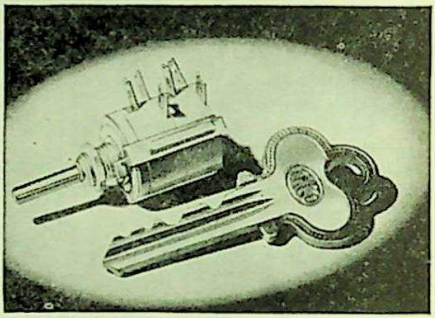
Sub-Miniature Volume Controls



No bigger than a dime! That immediately describes the miniaturization achieved in the Series 48 composition-element sub-miniature controls developed by Clarostat Mfg. Co., of Dover, N. H. These controls are available on special order.

The controls are fit companions for sub-miniature tubes in ultra-compact electronic assemblies. Each unit, housed in a yellow low-loss bakelite case, measures ⅝" in diameter and ⅜" deep. Two units can be nested together and held by metal straps for dual-control combinations. The units are available in resistance values up to 3 megohms linear, and in tapers up to 1 megohm. Round or slotted shafts are available, and also a shaft-locking arrangement. The controls are said to be ruggedly built for dependable service.

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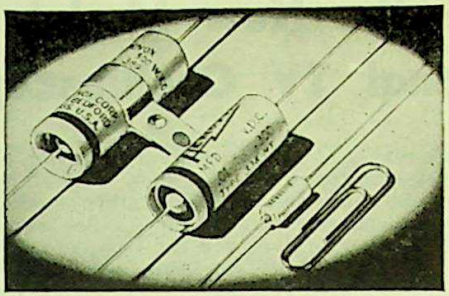
Capacitor Sizes Down—Operating Temperatures Up

"We believed our capacitors were already pretty rugged when we attained an operating tempera-



ture rating of 65°C. back in 1940," states Louis Kan, Director of Research for Aerovox Corporation, New Bedford, Mass. "That was for our type 89 oil-impregnated metal-can tubular, measuring 11/16" in diameter by 2-3/16" long. By 1945 we had the noticeably smaller type 38, rated at 85°C. and measuring ⅜" in diameter by 1⅛" long. And now, for 1951 and in keeping with the miniaturization trend, we have taken one tremendous step in attaining the micro-miniature type 123Z tubular rated at 85°C. and capable of operating at 100°C., with its vitrified ceramic sealed metal can yet measuring only .175" in diameter by 7/16" long. The three capacitors used for comparison are .01 mfd., 200 V.D.C."

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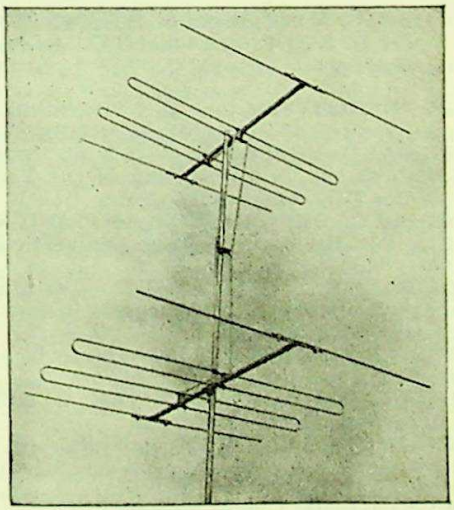
New Antenna Eliminates Co-Channel Interference



A new antenna, designed to minimize or eliminate co-channel interference is announced by the Technical Appliance Corp., Sherburne, N. Y., manufacturers of Taco antennas. Front to back ratio of the new Twin-Driven Yagi is 30 db.

Grateful Graduate Writes to the Veterans' Administration, Washington, D. C.

Director of Training
Veterans' Administration
Washington, D. C.

Dear Sir:
"For over one year now I have been taking a home instruction course in Radio Communications from the National Radio Institute, 16th and U Streets, N.W., Washington, D. C., under the GI Bill.

"The training staff at NRI has at all times been very helpful and patient. They have done everything in their power to make my progress a bit easier. They have been of much assistance to me in connection with the laboratory work.

"In view of the above, I wish to recommend the school and its excellent staff to you. I believe that this school is doing a very great amount of good in training technicians and that it can sincerely be recommended to anyone desiring to take up Radio Servicing or Radio Communications work.

"You, and your staff, have been very helpful, too; and to you, my very sincere thanks for your efforts on my behalf."

Very truly yours,

CARL PORTER
1811 Shortline
Corpus Christi, Texas

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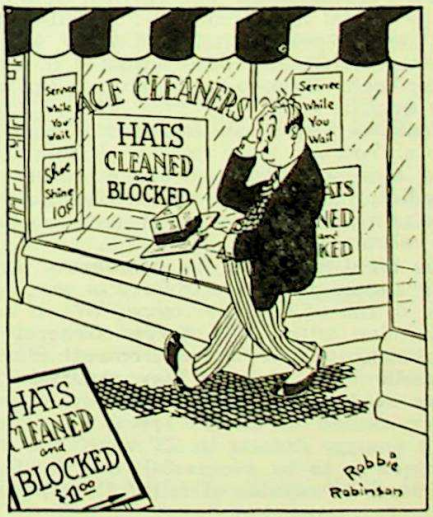


NOW We Announce the New Model 55 NRI Professional TV Oscilloscope

THE new Model 55 NRI Professional TV Oscilloscope is now available. It is designed especially for TV service work. But that's not all! It is also ideal for use on AM-FM receivers, public address, or high fidelity audio amplifiers, and general electronic applications!

Best of all, you don't have to be an engineer to use this instrument. A detailed instruction book, *written in everyday language, so anyone can understand it,* is included.

With the NRI Professional TV Oscilloscope there is no need to guess about circuit operation. You can tell quickly which circuits are operating normally. This Scope permits you to examine signals which can tell a real story at almost any point in a Television receiver. Its *wide-band response* (essentially flat from 10 cycles to 4.5 mc. and useful to 7 mc.) means accurate reproduction of high-frequency pulses—no guesswork here. Even the tough service jobs become easy when you use the Model 55 TV Oscilloscope to diagnose the complaint and track down trouble.

Has Many Uses

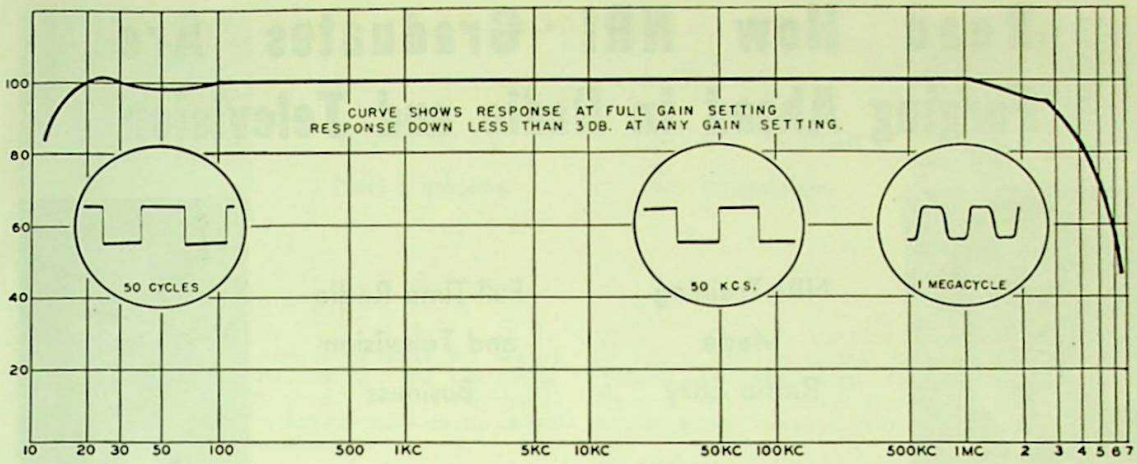
1. Television Signal Tracing. High sensitivity enables you, by using a Detector Probe, to trace the TV signal from the first video i-f amplifier to the grid of the picture tube.
2. Checking TV "Sync" Pulses. Shows "sync" pulse as it actually exists—no distortion due to the oscilloscope.
3. Measures Peak-to-Peak Voltages Directly—Without Calculations. The Vertical Gain control on the Model 55 is conveniently calibrated to read peak-to-peak voltages directly when the pattern on the CR tube is adjusted to a height of one inch. Peak-to-peak voltages up to 1000 volts may be read.
4. Measures Stage Gain in AM, FM, and TV receivers. You can trace the signal from stage to stage, measure input and output voltages, and immediately spot weak stages. Use the Oscilloscope as a calibrated, direct-reading a.c. vacuum tube voltmeter.
5. The Ideal Scope for TV Alignment. In Television alignment it is necessary to see the true shape of the i-f response curve. When used in conjunction with a TV Sweep Generator, the Model 55 Scope fills this requirement admirably.
6. Excellent for "Square Wave Analysis" Techniques used in TV Servicing. Many up-to-date TV servicemen are using a test square wave signal to analyze defects in TV receivers. If this technique is to be successful, the Oscilloscope used must be capable of faithfully reproducing square waves of frequencies varying from about 50 cycles to about 500,000 cycles. The Model 55 does this, and more, with negligible "rounding" of a 1 megacycle square wave. (See response curve.) You can even see the complete "front" and "back porch" of Television "sync" pulses.
7. AM-FM Signal Tracing. See and follow signals in AM and FM receivers. Distortion in a given stage is immediately identified, and the source of the distortion quickly located.
8. Speeds AM-FM Servicing. Checks effectiveness of by-pass and filter condensers of all types. Quickly locates hum, distortion, and noise. Assists in accurate FM alignment.
9. Provides a Reliable Check for Auto Radio Vibrators. Dynamically checks vibrators in the receiver. Immediately detects vibrator "hash."
10. Miscellaneous Uses. Can be used as a high impedance a.c. voltmeter, output indicator, transmitter modulation indicator, or in practically any industrial or electronic operation.

Compare These Specifications Before You Buy

You will be amazed at the favorable comparison of the Model 55 Oscilloscope to instruments costing much more. You get the benefit of our low price because there are no middle-man profits. The Scope goes directly from NRI to you.

Here are some of the special features which make the Model 55 NRI Professional TV Oscilloscope so outstanding:

HIGH SENSITIVITY—one inch deflection with a signal voltage of only .014 volt (RMS).
WIDE-BAND RESPONSE — ±3 db from 10 cycles to 4.5 mc. at any setting of the Vertical Attenuator Control; useful to 7 mc.
PUSH-PULL DEFLECTION AMPLIFIERS — used in both the horizontal and the vertical circuits.
WIDE-RANGE LINEAR SWEEP — continuous coverage from 10 cps to 100,000 cps in four separate overlapping ranges.
FUSED PRIMARY CIRCUIT — protects power transformer and line.
VOLTAGE-REGULATED POWER SUPPLY—for maximum stability.
HIGH IMPEDANCE INPUT — to minimize loading of critical circuits. (On X1 Vert. Attenuator setting, 3 meg., 50 mmf.; X10 scale, 1 meg., 28 mmf.; X100 scale, 1 meg., 22 mmf.)
POSITIVE SYNC CIRCUIT — used in internal sweep section. Will lock in with sine-wave signals as high as 3 mcs.
FREQUENCY-COMPENSATED THREE-STEP ATTENUATOR — permits high-voltage signals


CURVE SHOWS RESPONSE AT FULL GAIN SETTING
RESPONSE DOWN LESS THAN 3DB. AT ANY GAIN SETTING.
50 CYCLES
50 KCS.
1 MEGACYCLE
100
80
60
40
20
10 20 30 50 100 500 1KC 5KC 10KC 50KC 100KC 500KC 1MC 2 3 4 5 6 7

The above graph shows the excellent frequency response of the vertical amplifier section of the NRI Professional TV Oscilloscope. The three waveforms inserted below the curve are actual reproductions of waveforms as they appear when undistorted square wave signals are applied to the vertical amplifier terminals. Little rounding of the square wave occurs at frequencies as high as 1 megacycle, and negligible tilt occurs as low as 50 cycles.

(up to 1000 volts peak-to-peak) to be observed without distortion.

EXPANDED SWEEP — enables detailed observation of small sections of the pattern.

MAGNETIC SHIELDING — provided for the Cathode-Ray Tube prevents stray signal pick-up.

TEST SIGNAL FOR CALIBRATION—2 volts, peak-to-peak, 60-cycle sinusoidal signal available for checking calibration of Vertical Attenuator.

RETURN TRACE BLANKING — reduce intensity of retrace line.

INTENSITY MODULATION — "Z" axis terminal provided on front panel for intensity modulation.

VERSATILE HORIZONTAL SWEEP CIRCUIT —can be used as horizontal amplifier, or as a built-in linear sweep, synced with the 60-cycle line, or with external or internal signals.

EMPLOYS THIRTEEN MODERN TUBES — type 5UP1 five-inch cathode-ray tube, gives sharp focus and pattern; 5U4 L.V. rectifier; 5Y3 H.V. rectifier; two OA2's—low voltage regulator tubes; 12AU7 push-pull horizontal sweep amplifier; two 6AG7's—vertical push-pull sweep amplifiers; 12AT7 (dual purpose) cathode follower and triode voltage amplifier; 6CB6 vertical voltage amplifier; 6C4 vertical amplifier phase-inverter; 12AT7 multivibrator linear sweep generator; 6C4 horizontal voltage amplifier.

POWER REQUIRED — 50-60 cycle, 110-125 volts A.C. required. (Cannot be operated on D.C. or 25 cycle A.C.)

Circuits used in this instrument are licensed under American Telephone and Telegraph Corporation (A.T.&T.) and the Radio Corporation of America (RCA) patents.

Impressive Cabinet and Panel Design

Dark maroon wrinkle finish cabinet and black front panel are of sturdy steel construction Match other NRI Test instruments. Panel size is 10½ inches by 13¾ inches. Depth of the cabinet is 16 inches. Net weight is 36½ pounds. Shipping weight is 42 pounds.

This is a truly sensational instrument offered at the remarkably low price of $127.50, with order. The instrument is sent express charges collect. (Personal check should be certified to avoid delay of 15 days in shipment waiting for check to clear.)

Use This Order Blank

National Radio Institute
16th & You Streets, N. W.
Washington 9, D. C.

Mod. 55

Enclosed is $127.50 (certified check, money order, or bank draft) for which send me, express charges collect, one Model 55 NRI Professional TV Oscilloscope, instruction manual included.

Name..... Student No.....

Address .....

City..... Zone..... State.....

EXPRESS OFFICE .....

If you live in Washington, D. C., add 2% for D. C. Sales Tax.

Read How NRI Graduates Are Forging Ahead In Radio and Television

NRI Training Made Radio Easy

"Before taking your course I was only a radio mechanic without any knowledge of what went on in a radio. Your Course made radio so easy that I don't hesitate to tell customers to bring their radio to the shop and I'll fix it easy.

"Your kits were the real pay-off as far as practical experience goes. I was amazed at how simple the various tests and measurements were.

"I now have my own spare-time business and have plenty of work."

ELMER A. JOHNSON
37 Green Street
Webster, Mass.

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Full-Time Radio and Television Business

"I am owner of my own business. I have a full time sales and service business with my wife selling. I also do part time servicing after my regular day at another job. I am doing very well.

"I am now starting in TV; having sold some sets. I am going into TV servicing. I am an authorized Philco man in my town. I am now earning about $1,800 to $2,200 for my part time servicing."

ANTHONY MILLS
313 Mathew St.
Rome, N. Y.

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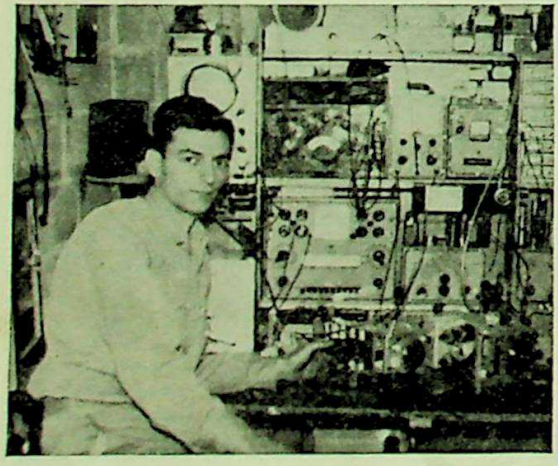
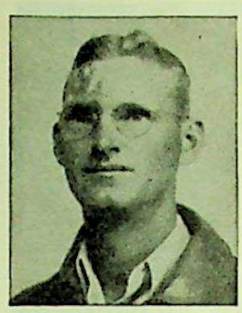


$65 to $85 a Week In Radio and Television

"Within three months after I started my studies I had a spare-time income large enough to buy the equipment needed to repair any radio or TV set.

"At present I work for the Tinicum Radio and TV Co. from nine until three for which I receive $50 a week. The work I do in my own shop brings in another $15 to $30 a week. Since my graduation from NRI I have made close to $1,000 in my spare time. As you said, fear is failure, and I have not failed yet."

GEORGE MADORE
333 Holmes Rd.
Holmes, Penna.



Proud of his NRI Diploma

"I appreciate what you have done for me. I have received my NRI diploma and I'm really and truly proud of it. The school is wonderful and I recommend it to anyone who wants to get ahead in radio and electronics.

"For a time I did spare-time servicing here on the farm. I did fine, and my customers all seemed to be well pleased. Now I am employed here in my home town by one of the very best radio men in this part of the country. He praises NRI very highly.

"I am ready and willing to help anyone who may be interested in radio and electronics, and will always recommend NRI first of all. I think NRI can't be beat."

J. C. AKINS
RFD 1
Brady, Texas

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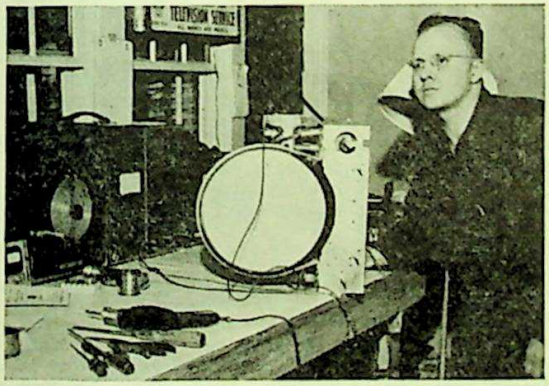

Full-Time Position In Television

"I am a Television and Radio Serviceman for Television Installation Co., Inc., in Miami, Florida. I am greatly pleased with this opportunity which resulted from NRI training.

"I have worked on nearly every model of TV sets on the market and have had excellent results in repairs because of my training at NRI. Effect-to-cause-reasoning is the key to successful repairs.

"During my training I repaired many sets in my spare time. The kits you sent were excellent for getting practical experience.

"For any person interested in Television and Radio training I would not hesitate to recommend NRI. I can't thank you enough for putting me into a field that has such a wonderful future."

JOHN L. ZIMMERMAN
Box 732
Coral Gables, Florida

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Flourishing Spare-Time Business

"I have a part-time Radio and Television business which is starting to crowd my regular occupation to the point where I shall have to do one or the other.

"To date, everything, including the NRI Course has been paid from the proceeds of my business. This includes test equipment and supplies. I also have a Jeep Station Wagon to take care of deliveries and service calls. The business takes care of the payments. Many thanks to NRI for everything I have today."

WILLIAM A. NOAH, JR.
19 Arcadia Court
Albany, New York

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As space permits, from time to time, we plan to devote a page or two in NR-TV News to short success stories such as above. They are taken from testimonial letters we have on file. Photographs and letters of this kind are always greatly appreciated by us. We feel we should pass them on to our readers for the inspiration to be gained from a reading of them.

PRACTICAL SERVICING OF AUTO RADIOS

By LEON LATHAM, NRI GRADUATE

of Streator, Illinois

Leon Latham

THE widespread popularity of the auto radio has opened new fields for profit for the serviceman. Generally speaking, the auto radio requires more servicing than the ordinary home radio. It receives more shock and is subject to greater temperature changes which are hard on the parts. Later designs have helped to overcome some of these faults, but there is still ample opportunity for the serviceman to cash in on this phase of servicing. Extra profit can be realized because of the "remove-install" fee and the extra labor it involves.

In my own experience, I have found it more profitable to make deals with garages whereby they remove the radios and bring them to my shop. I have found that many garages are anxious to have a steady, capable serviceman to do their radio repair work. I learned, too, that in most cases they were sending new sets back to the jobbers, so I offered to do their warranty work. This agreement proved satisfactory and in time I was servicing the factory warranty contracts as well, and eventually I was servicing all defective sets. Warranty work is not too profitable, but it brings in other sets which do pay off. At present I am doing about 20% warranty and 80% non-warranty work for seven garages in a town with a population of about 25,000.

Many servicemen miss out on this work because they do not advertise for it and some even refuse to do it, either because they do not realize the possibilities, or because they do not understand the car radio. The purpose of this article is to pass on my experience in auto radio servicing with the idea that some other serviceman might benefit by it.

Power Supply

(a) *Explanation of Power Supply.* The chief difference between the conventional home radio and the auto radio is the power supply. With a good understanding of the power supply you can service an auto set in the same way as any home radio. I will attempt a brief explanation of the power supply, and I suggest that the student thoroughly study his NRI texts on the subject.

The voltage supplied by a 6-volt battery must be increased to a higher voltage. To do this, a step-up transformer is used. However, a 6-volt battery supplies direct current, which cannot be induced into the secondary of a transformer, and which, if permitted to flow uninterrupted, would burn out the primary. To overcome this we must interrupt the 6 volt d.c. many times per second with an interrupter—commonly called a vibrator. (See Fig. 1) This produces an alternating voltage that can be stepped up by the power transformer to a higher a.c. voltage. The voltage is then rectified and smoothed by a choke, or resistor and filter condensers, and in the case of the non-synchronous vibrator, either a gaseous or heater rectifier tube is included. The output now is filtered d.c. voltage of about 250 volts or more, which can be applied to the tube plates and screens. When synchronous vibrators are used, battery polarity must be watched to avoid ruining the filter condenser. However, with the non-synchronous vibrator and a rectifier tube, polarity is of no consequence.

(b) *Common Complaints.* Generally speaking, the power supply is more apt to produce trouble than the other stages. Experience will show that in the majority of cases when an output tube is pulled out and replaced with no click being heard in the speaker, the power supply is almost certainly defective. More rarely a bad output transformer or open voice coil will give the same results. If the radio is dead, but will start playing on being jarred, or if there is no steady buzz when the set is turned on, suspect the vibrator, a common cause of trouble. Before

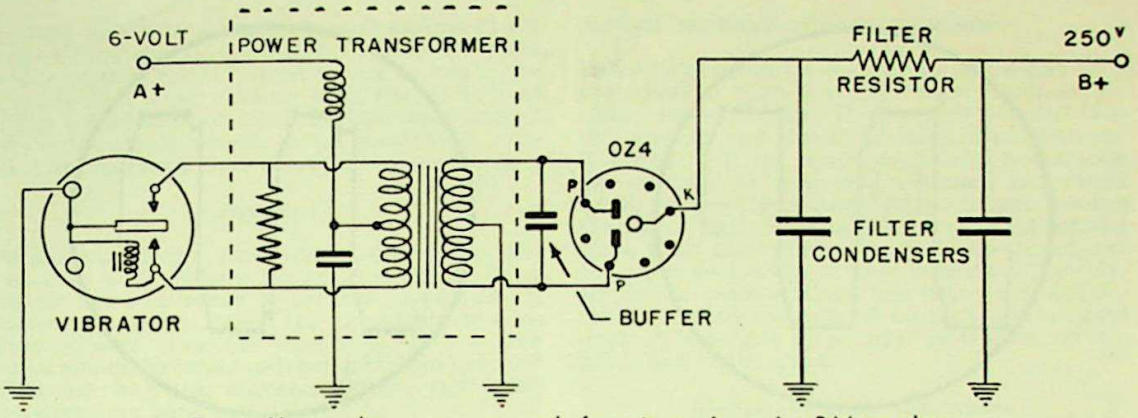

Fig. 1. Non-synchronous power supply for auto receiver using P.M. speaker.

replacing the vibrator, it is worth your time and money to check the buffer condenser. If this must be replaced, be sure to use a condenser with the same capacity and with a working voltage of at least 1600 volts. Experience will show, too, that if the correct capacity is not used, the new vibrator will be short-lived.

Some of the common causes of ruined vibrators are: improper setting of the car voltage regulators, shorted filter condensers, and arc-overs in the OZ4 tubes; more rarely, a shorted power transformer is responsible.

New vibrators may sometimes fail to start, especially if they have been on the shelf for a long time, because of tungsten oxide coating on the contacts. The contacts can be cleaned by applying 110 volts a.c. to the vibrating reed through a 40-watt lamp for at least thirty seconds. Ten minutes will do no harm. (See Fig. 2.) The car voltage regulator should be checked with a d.c. voltmeter for the following readings: with the motor off—6 volts; with the motor running—not more than 7 volts. If on racing the motor the voltmeter registers more than 7.7 volts, the voltage regulator will cause trouble and should be adjusted. It is best to have the auto mechanic do this.

Any serviceman fortunate enough to own an oscilloscope will find it an excellent instrument in checking vibrators. (See Figs. 3A, 3B, 3C, and 3D.) Fig. 3A shows an ideal picture; 3B indicates contacts which are worn or bouncing; 3C shows an open buffer, and 3D an overloaded circuit or shorted buffer.

Diagnosing Car Radio Trouble

Suppose a customer drives up with a radio that doesn't work. Before taking the radio out of the car (and many times this is done unnecessarily), the fuse should be checked, both for size and continuity. It should not be greater than 14 amps in most cases. A 20 or 30 amp fuse should be replaced immediately, since it has probably been put there to keep from blowing fuses when a defective radio is the real difficulty. If the fuse blows again or there is no vibrator buzz, the vibrator should be replaced—if possible without removing the radio. If there is a vibrator buzz, but no signal, the next procedure is to pull out the output tube. Absence of a click in the speaker when this is done indicates a possible power supply defect. Further check on this can be made by replacing the rectifier tube. If there is a click when replacing the output tube, the power supply output section and speaker are O.K.

The Antenna

The next procedure is to check the antenna for shorts. Even water leaks will give trouble here. An ohmmeter can be used for this check, but I find it more convenient to make a comparison test by using a piece of shielded cable with the proper connection to plug into the radio. On the other end is about four feet of rubber-covered wire. This cable is commonly used to lengthen antenna cables and can be purchased at any supply house. If the set fails to operate when this substitute is plugged in, the antenna is not defective. Next, tubes that are easily accessible should be checked. If this does not locate the

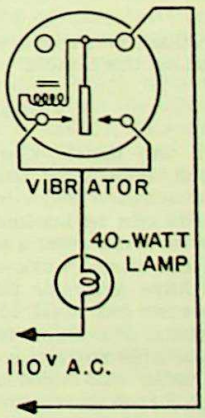

Fig. 2. Circuit for cleaning vibrator contacts.

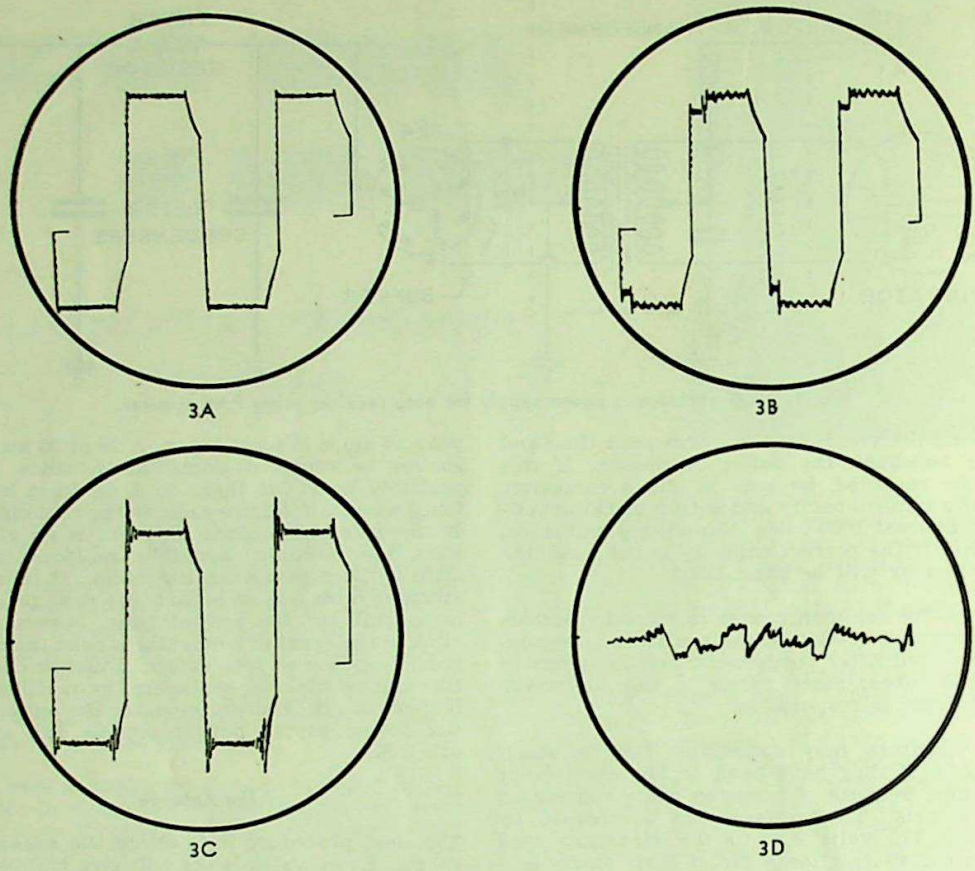

Fig. 3. A—Ideal waveform; B—Contacts worn or bouncing; C—Buffer condenser open; D—Shorted buffer condenser or overloaded circuit.

trouble, the radio will have to be removed and put on the bench.

RF and IF Sections

On the bench, the basic test instruments are used, especially the signal tracer. The circuit disturbance test can be used with no harm. The radio can be hooked up to a storage battery for power; however, a serviceman doing any amount of car radio work will find it to his advantage to have a power pack that will deliver enough current (at least 15 amps) for an auto radio at 6 volts. It is important that the power pack have a variable voltage control and an ammeter. Often a radio will work on the bench but not in the car because of such defects as hard starting vibrators, defective oscillators that cut out when the voltage drops too low, and stages that oscillate when the voltage is slightly above normal, as it is when the battery is being charged by the car generator. These things can easily be checked with a variable supply but might otherwise be overlooked.

The rf, i-f and oscillator stages are serviced in these sets just as in home radios, but it is well to be on the lookout for more defects of the mechanical type, such as broken connections to coils and sockets, shorted condensers, resistors and trimmers, and poor grounds due to vibration. Coil Q's may be lowered by moisture and trimmers may have moved. All these defects should be considered in servicing a weak receiver.

When normal procedures have failed to disclose a defect, a defective oscillator section can often be cured by using a hot iron on the joints. If it is necessary to make coil replacements, it is advisable to exactly duplicate parts. It is equally important that the connections be carefully watched. On one occasion I replaced an output

transformer with a duplicate part and could get only a loud squeal. How well I remembered the many wasted hours I spent trying to locate the trouble and finally found that the radio was using a feed-back circuit from the secondary of the output transformer. After making the connections correctly the radio operated perfectly.

Alignment

Alignment of the car radio is essentially the same as in home sets except that the antenna circuit must be tuned to the car aerial. In all cases it is best to follow the manufacturer's instructions if they are available. If not, the radio should be tuned to a weak station (around 1400 kc) and the antenna system tuned for maximum volume.

Audio Section

Common complaints in the audio section of these sets are similar to those in conventional receivers. Hum is usually caused by filter condensers and open buffers. Cathode-to-heater leakage in tubes will not cause hum since the heaters operate from d.c. voltage, with the exception that severe hum results if cathode-to-heater leakage occurs in a rectifier. The 6X5 is a frequent offender in this respect. Leaky coupling condensers, defective volume controls, mismatched output tubes, incorrect operating voltages, may all cause distortion, but the greatest offenders are defective speakers. Because of high humidity, dust, water splashing through the cowls, and vibration, speakers take a lot of punishment and their life is not too great. In cases of distortion, the speaker should be checked first. A new cone will work wonders. When sending in speakers for reconing (most supply houses offer this service to repairmen), it is an excellent idea to make a diagram of all the speaker connections, including those on the speaker itself, to facilitate reinstallation. Here again I found that through carelessness in not checking speakers with field coils that were returned to me after reconing, I was using the primary of the output transformer as the speaker field.

Automatic Tuning

Automatic tuning is an important item to be considered in servicing. It is usually mechanical and much more complicated than other types of tuning. *Lubriplate* (trade name of a widely used conductive lubricant) should be used sparingly. Solinoid plungers and iron-core slugs should never be lubricated because the cores absorb oil, become sticky and will not operate. In such a case it is best to make a replacement. If cleaning is attempted it should be done with thinner or naphtha—never carbon tet, since this leaves a film and may detune the radio. Switch contacts can be cleaned with carbon tet, although I prefer Electronic Switch Cleaner, a General Cement product, available at your wholesaler.

It is well to check all connections to be sure they are soldered tight. Special tuners, such as the signal seeking tuners (Delco product) are very complicated and should be worked on with extreme care. If the tuner continually hunts, look for an open or grounded antenna, and check tubes. Evidently enough signal is not coming through. This is usually the case. Anything more than the repairs listed above should not be attempted without the manufacturer's instructions because there are many fine adjustments of a thousandth of an inch and a great deal of time and effort can be wasted by the guess and try method.

Ignition and Static Interference

In cases of outside interference it is well to check for wheel static, loose bonding, ignition trouble and clock noise (a common Pontiac defect). The pulsation of the clock goes from the clock wire to the lead-in shielding, from the shielding into the enclosed wire, and thence to the radio input. Clock noise is frequently caused by failure to plug the antenna firmly into the receiver, and can usually be corrected by obtaining a better ground for the antenna shield at the receiver.

Spark plug suppressors should not be used unless necessary. Ignition interference is being eliminated in many of the newer model cars with special ignition cable and newer methods of wiring. An ammeter condenser, and occasionally a generator condenser, is all that is needed to stop ignition interference. You will seldom find shorted spark plates (condensers, formed by metal plates separated from the receiver chassis by mica or other dielectrics)—these should be replaced rather than disconnected. Vibrator hash may prove to be an annoyance. In this case checks should be made for poor bonding between tuner and chassis, between the power transformer and chassis, between the power supply shielding and chassis, and for a defective A+ by-pass condenser, vibrator primary resistor or the vibrator itself. If an OZ4 rectifier is used, a new one should be tried before doing anything else. In aggravated cases the OZ4 may be changed to a 6X5 with only slight wiring changes.

The serviceman should always use effect to cause reasoning before removing a radio and while servicing it. He should check all tubes, and be sure he has a good understanding of the vibrator power supply by a thorough reading of his texts. After the repair is finished, the radio should be checked by operating it for some time to make certain the defect has been corrected. During this period of operation, I usually jar the radio by dropping it on the bench from a height of about four inches. This eliminates the discouraging task of installing a radio only to have to

remove it again, especially in the case of intermittents.

During vacation time, there will be increased opportunities in car radio servicing which help in getting over any slow-down in home set repairs.

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(*Continued from Page* 11)

Once the i-f response curve is obtained, marker signals can then be injected, either from a built-in marker in the sweep generator or from a separate marker generator. The various i-f transformers and traps in the television receiver are then adjusted to give the desired response curve as shown in the manufacturer's service

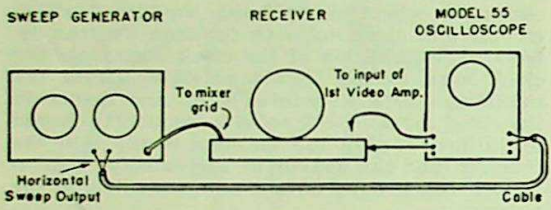

Fig. 14. Block diagram showing interconnections between sweep generator, TV receiver, and cathode-ray oscilloscope for TV receiver alignment.

manual. Any misadjusted stages immediately show up as a change in the response curve.

The oscilloscope, used with a sweep generator, is also useful for adjusting the ratio detector or discriminator used in the sound circuit of TV receivers or in those used in conventional FM broadcast receivers.

Summary of TV Servicing Notes: As we have seen, the cathode-ray oscilloscope is of tremendous value in TV work and is almost a necessity for certain jobs. It is often required for adjusting the horizontal AFC circuits in a receiver, for properly aligning the receiver, and for adjusting traps and other special circuits. It is also valuable when servicing a receiver and permits isolating a defect much more quickly than by many other servicing methods. This is particularly true when servicing sweep and sync circuits.

However, the scope is always used in conjunction with "effect-to-cause" reasoning. It is used primarily to isolate trouble to a stage in a section after the section has been isolated by means of reasoning and by operational tests with the receiver.

Conclusion: The cathode-ray oscilloscope is basically an instrument permitting the technician to *see* the exact waveform and amplitude of ac signals. Used in this fashion it is a valuable aid to AM and FM servicing and almost indispensable in TV servicing.

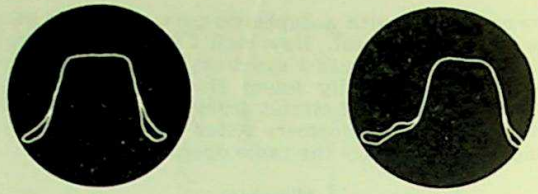

Fig. 15. (A) Typical i.f. response curve for a receiver with "intercarrier" sound; (B) typical i.f. response curve for receivers having a separate sound channel.

As a test instrument, the oscilloscope may be used as a signal tracer; it can be used for checking hum frequency and other audio frequencies; as a high impedance ac voltmeter or output meter; for checking distortion; for measuring gain; for checking coupling condensers, by-pass and filter condensers; and for making other special tests.

Descriptive literature on the Model 55 NRI Professional TV Oscilloscope may be obtained by writing to the NRI Supply Division.

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Our Cover Photo

Here is a typical scene from one of the NRI laboratories. Robert L. Simpson, NRI Consultant, is shown giving new Model 55 NRI Professional TV Oscilloscopes a thorough check before shipment to NRI Students and Graduates.

These Scopes undergo a complete operational check before leaving the factory to be sure that they are within specified tolerances of the rigid specifications set up by NRI. The instruments are then checked again here at NRI before shipment. We make use of the highest quality laboratory equipment in testing these instruments to be sure that they are "right" when they reach you.

High-Voltage TV Probe Now Available for Model 44 Volt-Ohm-Mil-Ammeter

The NRI Supply Division can now furnish High Voltage TV Probes to owners of the Model 44 NRI Professional Volt-Ohm-Mil-Ammeter. This probe will extend the d.c. voltmeter range of the Model 44 to 30,000 volts. Physical appearance is the same as the probe which we now offer for use with the NRI Model 45 Volt-Ohm-Mil-Ammeter, which is of course also available. The postpaid price of either probe is $7.00. Be sure to specify Model 44 or Model 45.

REPLACING TUBES WITH GERMANIUM DIODES

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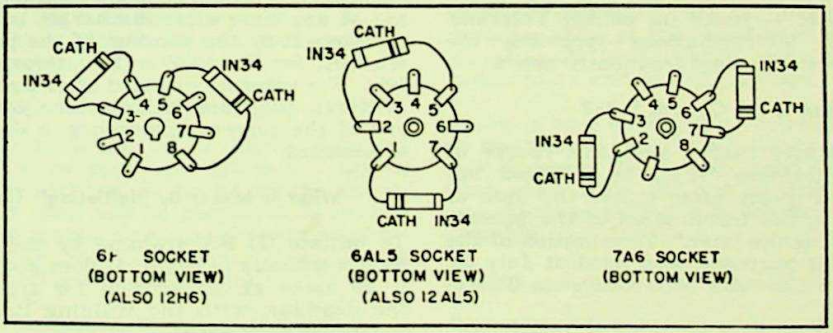
Germanium Diodes may be used as diode and duo-diode detectors in original installations or as replacement of diode and duo-diode type vacuum tubes in home-made radio receivers, AM and FM tuners, and TV sets. This change is often desirable since the Germanium Diode has no filament and, therefore, requires no heating current. The Germanium Diode will also eliminate any hum produced by the tube it replaces, will generate no heat, and, in many instances, will afford better reception. Tubes which may be replaced successfully are types 6AL5, 6H6, 6H6G, 7A6, 12AL5, and 12H6.

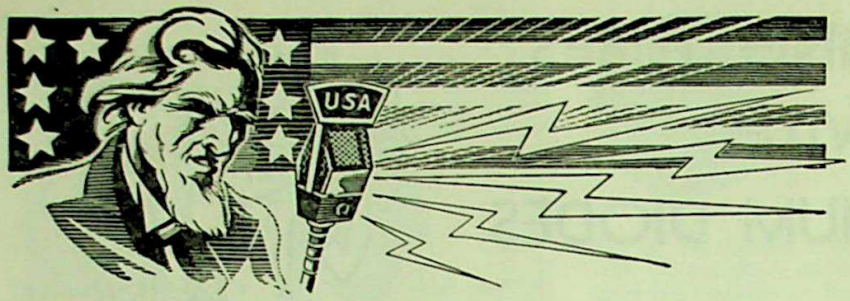


The substitution of Germanium Diodes for a tube involves only a simple soldering operation in many cases. There are instances, however, where a circuit change may be necessary to obtain the best performance from the diode. In the event that the substituted Germanium Diode results in a markedly lower signal level, the value of load resistor or resistors should be checked. Germanium Diodes work most efficiently into loads of 50,000 to 100,000 ohms rather than the 250,000 ohms or so commonly used with vacuum tube diodes.

Two Germanium Diodes will be needed for each tube replacement. Simply turn the receiver chassis upside down, remove the diode-type tube from its socket, and solder the pigtail leads of the 1N34's to the proper socket contact lugs, as shown in the accompanying illustration. Do not disturb any of the wiring to the socket. It will not be necessary to disconnect the filament wires from the socket, since no current is drawn through these leads when the tube is removed from the socket.

In ac-dc sets and others in which the tube filaments are connected in series, a special wirewound resistor must be connected between the filament lugs of the socket when the tube is replaced with crystals. The following table shows the correct value of resistor to use, and the socket terminals between which it must be connected.

Tube Replaced	*Wirewound Substitution Resistor*	*Socket Terminals For resistor Connection*
6AL5	21 ohms, 5 watts	3 and 4
6H6, 6H6G	21 ohms, 5 watts	2 and 7
7A6	42 ohms, 2 watts	1 and 8
12AL5	84 ohms, 2 watts	3 and 4
12H6	84 ohms, 2 watts	2 and 7



GI EDUCATION DEADLINES

Cut-off Date for GI Bill Education and Training and Termination Dates for GI Bill and Public Law 16 Training

The following paragraphs apply to NRI students and are parts of a special bulletin published by Vet-Times, 3132 M St., N.W., Washington 7, D. C. (Reprinted by permission.)

EX-SERVICEMEN and women have been asking questions about the approaching July 25, 1951 cut-off date for GI Bill education and training. Many others have been asking about the termination dates of the GI Bill and Public Law 16.

This V-T Report — based on official Veterans' Administration interpretations — provides the answers to questions most frequently asked.

When Is the Cut-Off Date?

The GI Bill states that a veteran's course of education or training "shall be initiated not later than four years after either the date of his discharge or the termination of the present war, whichever is the later." Termination of the war, for GI Bill purposes, was fixed at July 25, 1947, by Public Law 239, 80th Congress. Therefore . . .

1. Veterans discharged on or before July 25, 1947 (and this includes most World War II veterans) must begin GI Bill training by July 25, 1951.

2. Veterans discharged after July 25, 1947, must start within four years from their date of discharge.

3. Veterans who enlisted or re-enlisted under the Voluntary Recruitment Act (Between Oct. 6, 1945 and Oct. 5, 1946) may count the entire period of their enlistment or re-enlistment as war service for GI Bill purposes. They must start training within four years from the end of their enlistment or re-enlistment period.

Is There A Cut-Off Date for Public Law 16?

There is no cut-off date for starting courses under Public Law 16, the Vocational Rehabilitation Act for disabled veterans.

Disabled veterans may begin Public Law 16 training at any time after discharge, but in time to complete it by the wind-up of the program. The wind-up, for World War II veterans, is July 25, 1956. For veterans disabled after fighting started in Korea, the termination is nine years from the end of the current emergency, a date yet to be established.

What Is Meant By "Initiating" Training?

To initiate GI Bill training by the cut-off date means actually to begin. It does *not* mean merely to make an application for training before the deadline, with the training itself to begin sometime afterwards.

Veterans actually in training by cut-off time will be allowed to continue afterwards. Veterans not in training by that date may not start afterwards—though there are some exceptions.

Post-Cut-Off Date Training

A veteran continuing a GI Bill course after the cut-off date will be expected to pursue his training continuously until completion. Once he completes or discontinues his GI Bill course after the deadline, he may not start another course.

Changes of Course After the Cut-off Date

Public Law 610, which permits a veteran to make

a first change of general fields of study merely by applying for it, will not be in effect after the cut-off date. Instead, a veteran will be permitted to change his educational objective only while in training and then for reasons satisfactory to VA.

Satisfactory reasons for change are these:

1. When a veteran is not making satisfactory progress in his present course and the failure is not due to his own misconduct, neglect or lack of application.
2. When the course to which he desires to change is more in keeping with his aptitude, previous education, training or other such pertinent facts.
3. When the course to which he wants to change is a normal progression from his current course, and will help him attain his educational or vocational objective.

No additional changes of course will be approved, except for the most cogent reasons. By change of course, VA means a change in the over-all program of study.

Are There Any Special Rulings That Apply In Special Circumstances?

In several instances, VA has made special rulings with respect to the GI Bill cut-off date. The rulings have been necessary to apply the cut-off date to special circumstances.

All of VA's special rulings are consistent with the law and with VA's basic regulations on the training deadline. Below are descriptions of the special instances:

Return to Active Military Duty

Veterans who have started GI Bill training and interrupt it to go back into active military or naval service will not be bound by the cut-off date. Instead, they will be permitted to resume their training within a reasonable period following their release from active service, even though they get out after the cut-off date.

They will be subject to three requirements:

The conduct and progress in their GI Bill courses must have been satisfactory; the period of training obtainable after they are released from service will be limited to their remaining GI Bill entitlement, and they may not train beyond the termination of the GI Bill program (July 25, 1956 for most veterans).

This cut-off date extension applies only to veterans who already had started training, and are prevented from continuing with their training by reason of their return to uniform.

Reason for the extension. VA's regulations state that a veteran actually must be in training on the cut-off date, except for an interruption for reasons beyond his control. Return to active duty, VA ruled, is such an interruption.

Servicemen In Training

Many World War II veterans, now in active military service, have been taking GI Bill training during their spare time.

If they are forced to interrupt their studies because of military duties or transfers, the GI Bill cut-off date will not apply to them. Instead, they may resume their education within a reasonable period after their release from active duty. In fact, when they do re-enter GI Bill training, they may change from the part-time courses they were taking while in uniform to full-time studies in the same field.

These veteran-trainees also will be bound by the three requirements of satisfactory conduct and progress, training limited to remaining entitlement, and no training after the program's termination.

Reason for the extension. Here, too, VA has ruled that the interruption because of military duties or transfers is beyond the veterans' control.

When Does the GI Bill Program End?

The law states that no GI Bill education or training "shall be afforded beyond nine years after the termination of the present war." Termination date of the war, for GI Bill purposes, was July 25, 1947. Hence, the GI Bill program comes to an end on July 25, 1956.

There is one exception. Veterans who enlisted or re-enlisted under the Voluntary Recruitment Act (between Oct. 6, 1945, and Oct. 5, 1946) have nine years from the end of that enlistment or re-enlistment period in which to wind up GI Bill training.

When Does the Public Law 16 Program End?

World War II veterans who have disabilities incurred in or aggravated by service between Sept. 16, 1940 and July 25, 1947, have until July 25, 1956, to complete Public Law 16 training.

• • •

This applies to anyone considering starting a GI course:

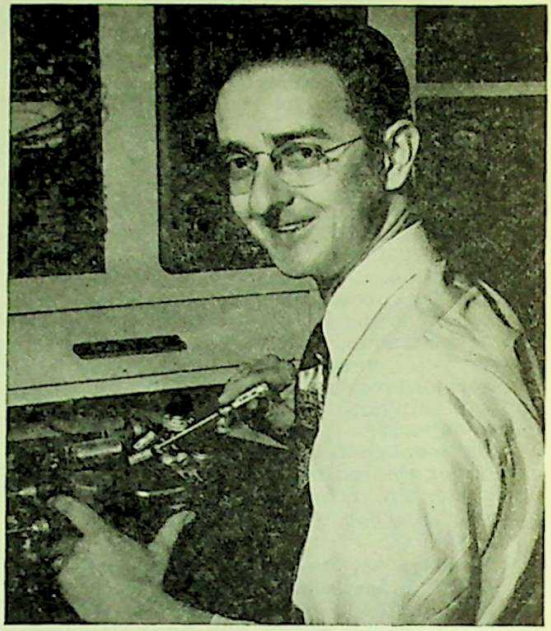
A valid Certificate must be in our hands so the enrollment can be completed on or before July 25, 1951.

A person in training on July 25 may keep on in the same course after that date as long as he remains in continuous training.

Converting Auto and Home Receivers for AM Police Reception

By DONALD E. KLINE

NRI Laboratory Instructor



Donald E. Kline

STANDARD automobile or home receivers can easily be adapted for limited short wave AM Police reception. Very few such receivers have been made. But, for a comparatively small cost, you can have this type short wave receiver, provided you already have an AM broadcast set. Home FM receivers cannot be converted for this purpose. When two-way FM transmission is employed by your local police, you cannot listen in with modified AM equipment.

When you adapt your car or home receiver for police reception, you will find that it has practical advantages. Any acting deputy could be called quickly to the scene of a crime or disaster. . You can avoid traffic congestion during an emergency period. Listening to police broadcasts as a pastime is interesting. Another thing is the added knowledge you get when you adapt your receiver for this kind of reception.

This conversion can be made on most AM receivers using either capacitive or inductive tuning. The cost of the conversion is little. A universal slug-tuned antenna coil, On-Off slide or rotary type switch, and a small length of hookup wire are all that is needed. These parts may be purchased from your local radio wholesaler.

Let us first consider the basic operation of an AM superheterodyne circuit. The preselector has the important job of accepting the desired signal and rejecting other signals which might possibly produce the correct i.f. beat. Since police broadcasts are far from the frequency to which the preselector is ordinarily tuned, the preselector rejects these signals, and this is why we are ordinarily unable to receive police reception. Therefore, it is necessary for us to make some change in the preselector tuned circuit that will enable the desired police frequency to be fed into the mixer tube. When these signals reach the mixer tube, a beat having a frequency equal to the i.f. frequency may be produced.

How can we change the preselector tuned circuit so that it will receive police transmission when it was originally designed for broadcast band reception (500 kc. to 1600 kc.)? In any tuned circuit, if the inductance or capacity is changed, the resonant frequency will be changed also. So, if we want to receive a higher frequency, we must lower the inductance or capacity in the tuned circuit. However, it is not necessary to remove the original coil and replace it with a new coil having lower inductance. Merely connect the new coil across (in parallel with) the original coil in the preselector tuned circuit. This will reduce the total inductance and tune the preselector to a higher frequency. (Two coils connected in parallel will have a total inductance lower than the individual inductance of either coil.) By using a switch in series with the new coil, you can connect it into the circuit at will.

Police transmitters do not broadcast continuous-

ly, so the easiest way to receive a signal for a long enough time to allow you to convert the set is to use a signal generator. Adjust the signal generator to the frequency of the police transmitter. (If this information is not known, ask your local police department.) The audio modulated r.f. output of the signal generator should be fed between the signal grid of the mixer tube and the chassis. Slowly tune the receiver over its complete range until the modulation tone of the signal generator is heard. The frequency of the local oscillator in the receiver (or one of the oscillator harmonics) is now such that police radio signals reaching the signal grid of the mixer tube will produce a beat frequency which is the same as the i.f. frequency of the set. But, in order for the police calls to be picked up by the antenna and eventually reach the mixer, the preselector tuned circuit must be tuned to the desired frequency (the frequency of the signal generator or the police station). This can be done by reducing the inductance in the tuned circuit. Adding additional inductance in parallel with the tuned circuit will reduce the effective inductance in the tuned circuit, thus raising its resonant frequency.

To prepare a suitable inductance from a universal antenna coil, remove the entire primary winding. If your receiver uses inductive tuning, the approximate number of turns to be removed from the secondary of your new coil should be from about thirty to sixty and you should begin by removing about twenty-five turns. If your receiver uses capacity tuning, about twenty-three to sixty-three turns should be removed and at the start you should take off about twenty turns. Now follow the procedure described in the next paragraph. (If you find that more turns have to be removed, do it in steps of five turns at a time at the start, removing a fewer number of turns in each succeeding operation so as not to overshoot your mark.)

To proceed, connect the signal generator, without changing its frequency, to the antenna and ground terminals of the receiver. Turn the output of the signal generator up so that the signal is heard weakly and then solder the extra inductance (with a series .0005-mfd. condenser as shown in Fig. 1) in parallel with the tuned circuit feeding the first tube in the receiver. This will be the r.f. tube if the set uses an r.f. stage. If it does not have an r.f. stage, this tuned circuit will feed into the mixer tube. An increase in volume may occur since this circuit is now tuned nearer the frequency of the signal generator. Adjust the slug in the added coil for least inductance (turn it out). In turning the slug from the "in" to the "out" position, if you are able to go through an adjustment which gives maximum output from the receiver, the coil has the correct inductance. If you don't reach resonance (maximum output) it will be necessary to remove some additional turns.

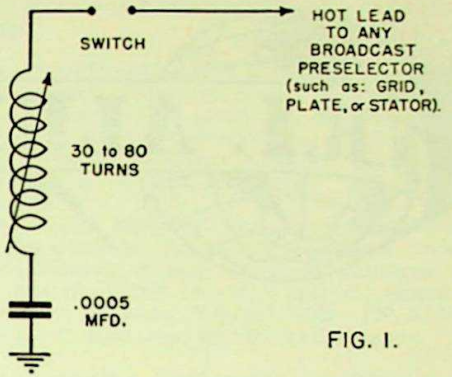


FIG. 1.

First, turn the slug all the way in, remove about five turns, and repeat the adjusting procedure. Continue removing turns, now only a few at a time, until adjustment of the slug gives a maximum output (greatest output at one adjustment with less ouput if the slug is then turned in or out). A single-pole single-throw switch should now be installed so one end of the coil can be disconnected or connected.

Keep the following very important fact in mind: these parts must be placed in a position that will allow the case and cover to fit together properly. By throwing the switch you can now bring in police broadcasts at will. Since the switch leads will carry r.f., mount the coil so that the leads will be as short as possible. If oscillation occurs, increase the cathode resistor of the r.f. preselector tube or shunt a resistor of around 100,000 ohms across the added coil. In the latter case, use the largest ohmic value which stops oscillation.

If the receiver uses an r.f. stage, the tuned circuit in the input of the mixer stage will still be resonant in the broadcast band, but the gain in signal strength by tuning the input r.f. circuit in the receiver will be sufficient in most cases to allow signals to be heard. A large increase in gain will result if the mixer tuned circuit is also shunted with a coil so it too will resonate at the desired frequency. However, if this is done, oscillation is more likely to result. The switch should be of the double-pole single-throw variety and should have low capacity between sections to reduce feedback. Adjustment of this additional shunt coil is made as described previously.

If a signal generator is not available, the job may still be done but much more time will be consumed. Without a signal generator, you must experimentally find the receiver dial setting for police reception and then make your coil adjustments when the police station is on the air. An outside antenna should be used for this and may be connected through a .01-mfd. condenser

(*Page* 30 *Please*)

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Louis J. Kunert ..... Vice Pres.
Louis L. Menne ..... Executive Secretary

"In common things of life lies the strength of the nation. It is not in brilliant conception and strokes of genius that we shall find the chief reliance of our country, but in the home, in the school and in religion. America will continue to defend these shrines. Every evil force that seeks to desecrate or destroy them will find that a Higher Power has endowed the people with an inherent spirit of resistance."

—Calvin Coolidge

Chapter Chatter

Baltimore Chapter. Member Thomas T. Kelly has been forced to resign from the office of Secretary because of pressing duties in his work with Bendix Radio, Towson, Maryland. Arthur F. Lutz is now filling the Secretary position. Both Kelly and Lutz are experienced hands in the job and are exceptionally capable as officers.

Five new members from the City of Baltimore have been admitted to the Chapter. They are George M. Butcher, Charles K. Eser, Edward F. Kaminski, James M. Royer, and George T. Wetzel. New members are one of the best signs of progress in a Chapter.

Not only has our Chairman, Elmer Shue, been doing an excellent job in his office, but he is also lecturing to the Chapter frequently. His subjects include general Oscillator Theory, and Power Supply Theory. H. Rathbun spoke to our Chapter on unusual Oscillator Circuits, and has also recently demonstrated the use of the Oscilloscope.

We have begun a series of lectures on Series and Parallel Resonant Circuits. Frank Orban, Treasurer, has delivered two lectures on this subject, and on other occasions, members Clifford Whitt and H. Rathbun have joined in talking on this subject.

Our Chapter recently held a general discussion on unfair practices in regard to Television service charges in this area.

A cordial invitation is extended to NRI students and graduates in this area to attend our meetings. Join us on any Tuesday evening of the month, with the exception of the first Tuesday, at Redmen's Hall, 745 West Baltimore Street.

Detroit Chapter. A committee to arrange for our annual June party has been selected and plans for the party are already well under way.

A Television receiver kit which was purchased some time ago by our Chapter has been completed, credit for the finishing touches due to Charlie Mills and F. Earl Oliver. This kit will be used for demonstrations in connection with lectures on Television. One meeting night has already been devoted to alignment of this receiver. We plan a complete series of experiments on the receiver.

Our RCA demonstration board will also be used soon to demonstrate the use of the NRI Signal Tracer and other NRI instruments.

We regularly conduct a service forum in which we discuss the problems of individual members, and repair any receivers brought in by the members.

We cordially invite NRI men in our area to visit our chapter. Meetings are held on the 2nd and 4th Friday of each month, at 8 P.M., 21 Henry Street—Corner Woodward. For further information, contact Secretary Kenneth L. Kacel, 5700 St. Clair, Detroit 13, Michigan.

New York Chapter. The Television Lecture course given by our member James J. Newbeck is continuing at each meeting. Subjects which he has discussed recently include Sound and Video i.f. Systems; Typical Video I.F. Systems; FM Discriminators; and Ratio Detectors.

Of course, the usual social activities continue along with our technical discussions. Thomas Hull and Alex Remer have added to the technical discussions from time to time.

Executive Secretary L. L. Menne from the Alumni Association Headquarters in Washington, D. C., visited one of our recent meetings. He spoke to the members concerning activities of our National Alumni Association.

Regular Meetings: first and third Thursday of each month, St. Mark's Community Center, 12 St. Mark's Place (between 2nd and 3rd Avenues), New York City.

Chicago Chapter. We feel that we are making steady progress. Little by little we solve problems such as the need for a good outdoor antenna.

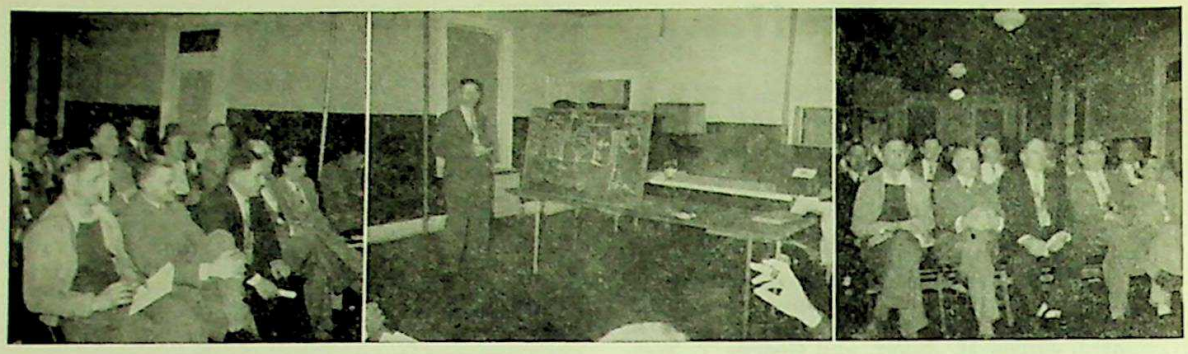
We are also preparing a display easel for the first floor entrance to our building. This should indicate to all entrants just where the Chapter gathers and our scheduled meeting nights.

Our Chapter benefits much by the study and delivery of technical information of member Louis Brodhage. As usual, we are ready to solve any technical problems which members may bring to meetings.

The officers of our chapter, under Chairman C. C. Mead, are doing splendid work. We cordially invite those in the Chicago area to meet with us on the second and fourth Wednesdays of the month, 8:00 P.M., in Tower space, 666 Lake Shore Drive, Chicago. This is the American Furniture Mart, West Entrance. Refreshments usually served.

Philadelphia-Camden Chapter. Our meetings are getting bigger and better by the turn-out that the attendance sheets show. It seems members are most hungry for Television, with Radio information being a close second.

One of the reasons members are attending more



Center, Harvey Morris lecturing to Phila-Camden Chapter. Left and right, Phila-Camden Chapter during a recent meeting.

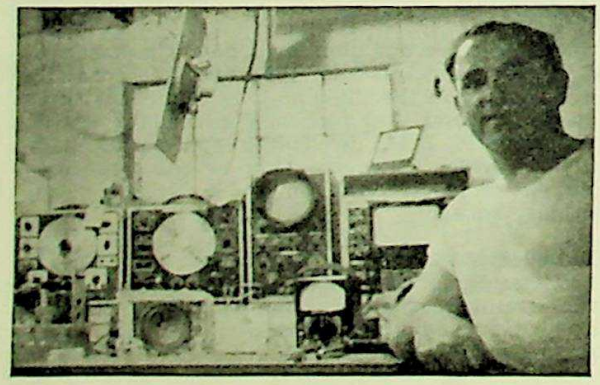
often is our new meeting place. Here it is a pleasure to listen to a lecture. Not a word is missed.

Our Harvey Morris does a very nice job of passing along Radio and especially Television information. He recently demonstrated the alignment of a Philco TV set using a Sweep Generator and an Oscilloscope.

The accompanying photographs show our Chapter in action, including one of the lectures by Harvey Morris. We also have a photograph of Fred Seganti at his workbench. He is doing fine in part-time Radio and TV repair. Several other members also are doing well and expect to furnish photographs of their shops soon.

At one of our recent meetings, Mr. Bernie Bycer, Manager of the LeHigh Radio and Television Company, gave us a lecture on "Sync Circuits," and the turn-out was really good. Our members, to show their appreciation, voted to accept Mr. Bycer as an honorary member of our Chapter.

We hope soon to have a representative from Zenith speak to us on Television. Top-notch lecturers add to the interest of our meetings.



Fred Seganti, of Phila-Camden Chapter.

We meet on the second and fourth Monday of the month at the K. of C. Hall, Tulip & Tyson Streets, Philadelphia. All graduates and students of NRI are more than welcome. Contact our Secretary, Mr. Jules Cohen, 2527 N. Marston Street, Philadelphia, Penna., for additional information.

———— *n r i* ————

(*Continued from Page* 27)

directly to the mixer tube signal grid. Then you must tune the receiver until police signals are picked up. Once the correct receiver dial setting for police reception has been experimentally established, you may connect the outside antenna to the plate of the r.f. tube and adjust the shunting coil across the mixer input tuned circuit if a shunting coil is used here; then connect the outside antenna to the antenna terminal of the set and adjust the shunt coil in the input tuned circuit. When only one shunting coil is used, shift the external antenna from the grid to the mixer tube to the antenna terminal and peak of this coil. (If sufficient signal is not thus obtained, a shunting coil across the mixer input tuned circuit also will probably be necessary.)

EDITOR'S NOTE: In some communities it is illegal to listen to broadcasts from police transmitters. Although most cities have no such restrictions, you should check with the local authorities before converting any set to receive police broadcasts. NRI does not accept responsibility for any individual operating any radio device contrary to law.

———— *n r i* ————

A mighty king was stricken with a strange malady, for which the physicians could find no remedy. A sooth-sayer told him that if he wore the shirt of a happy man, he would recover. With fresh hope, the king ordered the country searched for his happiest subject—but alas! when they found him, he had no shirt!

———— *n r i* ————

Self-confidence is the greatest of all victories.—Plato.

Here And There Among Alumni Members

NRI Graduate James W. Bruce, of Willoughby, Ohio, now does all the radio, phonograph, and amplifier service work for Carter Television, S. Euclid, Ohio.

n r i

Alumnus Charles F. Wilhelm, who lives in Easton, Maryland, has accepted a new position as a technician with the Atomic Television Company of Baltimore, Maryland.

n r i

We send our best wishes to Alumni member Walter Fiedor, of Chicago, Ill., who is sick and at present confined to the V.A. Hospital in Waukesha, Wisc.

n r i

Part of the vacation trip of Ben G. Herndon, Jr., and family, of Norfolk, Va., consisted of a visit to NRI. Herndon is a full-time machinist and a spare-time Radio serviceman. Also raises rabbits.

n r i

Graduate E. J. Schmidt, of Virgil, Ont., Canada writes a very nice letter in which he mentions working his way up from a pulp-wood cutter to a well paying and respected position with the Ontario Hydro-Electric Power Commission. Says "NRI built a solid foundation for me."

n r i

Paul G. Miller, who owns and operates Radio and Electrical Appliance Co., of Maumee, Ohio, has been appointed official factory service representative for Bendix Aviation. There's a fellow who is coming along fast.

n r i

The "Baker Twins," both NRI Grads, are doing well in radio. Arland G. Baker has his own radio shop in Valliant, Okla., and Arnold T. Baker has been doing part-time radio work in Nashville, Tenn. Fine work, boys!

n r i

Homer L. Anthes, of Overland, Missouri, has accepted a position as Radiomechanic with McDonnell Aircraft Corp., St. Louis, Missouri.

n r i

Graduate J. Armstrong Monell of New York City (Manhattan) reports a very profitable specialty. He changes AC receivers to AC-DC operation. Says this problem can become very complex in larger receivers.

n r i

Dr. Oscar L. Levitt, of Brooklyn, N. Y., visited NRI while on a business trip. Dr. Levitt has already completed Radio and Television Servicing with NRI, and is now taking Radio and Television Communications. His particular hobby is high-fidelity sound reproducing system in his home.

From the West Coast we have word that Alumnus Vera Verge Thomas has established his own business in San Francisco, Calif. His business is known as the Blue Front Radio Repair Shop.

n r i

Vodra Fisher, of Cincinnati, Ohio, is doing repair work for a Motorola Television Dealer in Montgomery, Ohio. Has all the work he can handle.

n r i

Harry T. Hubbart, of Metropolis, Illinois, is a transmitter operator for Station WMOK. He also does radio maintenance for a local cab company. Signs his letter "100% NRI Booster."

n r i

Pat Bolognese of Buffalo, New York, has a new job as an Electronic Repairman on Spot Welding equipment with a new plant in Buffalo. Says his pay starts at well over $300 a month, with more increases to come. He also does spare-time Radio work.

n r i

One of our Canadian friends, Stanley Barstead, of Renfrew, Ont., Canada, reports that he is now in charge of the General Electric service depot for his town and vicinity. He reports that his area is beginning to become interested in Television.

n r i

Clyde E. Pheil reports that he has his first-class Radiotelephone ticket, and that he is employed at Radio Station WCNH, Quincy, Florida.

n r i

Graduate Ray Luttrell, of Huntsville, Alabama; reports that he recently obtained his second-class Radiotelephone license, and expects to receive his first-class license soon. Luttrell is now a senior at Florence State Teachers College.

n r i

One of the partners in Jay's and Gray's Radio Clinic, Riverside, Rhode Island, is NRI Graduate Frank C. Gray. Congratulations are due on the establishment of a fine business.

n r i

We are grieved to hear that Larry Arthur, of Baltimore, passed away. He had been sick for some time. Larry held office in Baltimore Chapter at one time or another, serving as assistant Secretary and Vice Chairman. He was the type of man who is known as a team worker. Always pulling in the right direction, but never seeking honors for himself. We'll miss Larry.

n r i

W.O. (jg) F. G. Kahlert, NRI Grad, visited us while en route to rejoin his National Guard Battalion in Camp Stewart, Ga. Kahlert was in charge of the first National Guard Unit to be called from the District of Columbia, a Radar maintenance unit.

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